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PROJECT TECHNICAL REPORT  
TASK E&DD-702C

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TRW VORTEX-LATTICE METHOD SUBSONIC AERODYNAMIC  
ANALYSIS FOR MULTIPLE-LIFTING-SURFACES (N. SURFACE)  
TRW PROGRAM NUMBER HA010B

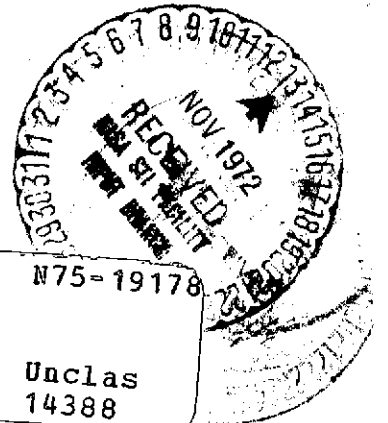
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NAS 9-12330

1 SEPTEMBER 1972

Prepared for  
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
MANNED SPACECRAFT CENTER  
HOUSTON, TEXAS

Prepared by  
Applied Mechanics Department



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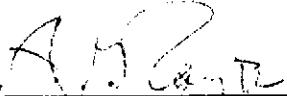
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## ABSTRACT

This manual provides a condensed users description and theory for TRW's Vortex-Lattice Method Subsonic Aerodynamic Analysis for Multiple-Lifting-Surfaces (N. Surface) Program HA010B. The program is designed to provide solutions of engineering accuracy for determining the aerodynamic loads on single- or multiple-lifting-surface configurations that represent vehicles in subsonic flight, e.g., wings, wing-tail, wing-canard, lifting bodies, etc. The manual describes the preparation of the input data, associated input arrangement, and the output format for the program data, including specification of the various operational details of the program such as array sizes, tape numbers utilized, and program dumps. As supplementary information, the manual includes a full description of the underlying theory used in the program development and a review of the program qualification tests.



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# LIST OF SYMBOLS<sup>†</sup>

AR	aspect ratio
b	span
B(X,Y,Z)	the first of two coordinate points that define the shape and location of a skew-shaped horseshoe vortex filament.
C	chord
$\bar{C}$	mean geometric chord (MGC), $\bar{C} = \frac{1}{S} \int_{-b/2}^{+b/2} C^2 dY$
$C_D$	wing drag coefficient
$c_d$	section drag coefficient
CF	aerodynamic cleanness factor
$c_F$	force coefficient
$c_h$	section hinge moment coefficient
$C_L$	wing lift coefficient
$c_\ell$	section lift coefficient
$c_{\ell_{al}}$	additional section lift coefficient
$c_{\ell_b}$	basic section lift coefficient
$C_M$	wing moment coefficient
$c_m$	section moment coefficient
Cn	$n = 1,2,3,\dots$ , constants
$C_N$	wing normal lift coefficient
$c_n$	section normal lift coefficient
$c_p$	pressure coefficient, $c_p = (p - p_\infty)/q_\infty$
$C_T$	wing thrust coefficient

<sup>†</sup>Note: Symbols defined in the text may be omitted from this list.

# LIST OF SYMBOLS (Continued)

$c_t$	section coefficient for thrust
$C_X$	force coefficient for X direction component
$c_x$	section coefficient for force acting in the X direction
$D(X,Y,Z)$	the second of two coordinate points that define the shape and location of a skew-shaped horseshoe vortex filament.
$F$	force
$F_n$	$n = 1,2, 3, \dots$ , etc., constants
$h$	height above the ground plane
$K$	total number of elemental panels
$L$	lift
$\ell$	length increment
$M$	Mach number
$\overline{m}$	lift slope
$p$	pressure
$P(X,Y,Z)$	coordinates of a field point for which the induced-velocity vector is calculated.
$q_\infty$	dynamic pressure, $q_\infty = 1/2 \rho_\infty v_\infty^2$
$R$	radius
$r$	distance from the <sup><math>\rho</math></sup> origin
$Re$	Reynolds number
$S$	wing area
$s$	scale
$t_1$	elapsed time (seconds) measured from the start of the execution of the program
$t_2$	elapsed time (seconds) for the execution of the last case
$V_\infty$	free stream velocity
$W$	dummy span defined as the independent variable in the interpolation routine used to calculate the lifting-surfaces span dimensions (see Section 7.4[6]).



# LIST OF SYMBOLS (Continued)

X	}	coordinate axes of a right-handed Cartesian coordinate system.
Y		
Z		
$\bar{X}$	}	X-Y-Z coordinates that locate the 1/4 chord of the mean geometric chord (MGC) location in the general coordinate system.
$\bar{Y}$		
$\bar{Z}$		
$\alpha$		wing angle of attack measured on the X-Z plane relative to the X-coordinate axis and the free stream velocity vector.
$\alpha_{R_0}$		wing angle of attack for zero lift ( $C_L = 0$ )
$\beta$		Prandtl-Glauert compressibility factor, $\beta = \sqrt{1 - M_\infty^2}$
$\Gamma$		circulation strength of a vortex filament
$\delta$		increment of span
$\delta_f$		deflection of flap
$\delta_{LA}$		deflection of left aileron
$\delta_{RA}$		deflection of right aileron
$\delta_{tab}$		deflection of trim-tab
$\Delta$		determinant
$\Delta L$		increment in lift
$\Delta S$		increment in area
$\epsilon$		geometric twist (angle) of chord plane
$\Lambda$		sweepback angle
$\pi$		pi, $\pi = 3.14159$ (as used in the program)
$\rho_\infty$		free stream density
$\phi$		dihedral angle
$\vec{\psi}$		influence function coefficient
$\psi$		scalar part of the influence function coefficient
$l\vec{AB}$		unit vector defined by two field points A(X,Y,Z) and B(X,Y,Z).
$l\vec{N}$		unit vector normal to a surface
$l\vec{V}$		unit vector for the induced velocity

# LIST OF SYMBOLS (Continued)

$\vec{i}_X$   
 $\vec{i}_Y$   
 $\vec{i}_Z$

} unit vectors parallel to the X, Y, Z, coordinate axes respectively.

## SUBSCRIPTS:

CG	center of gravity
CP	center of pressure
C/4	one-quarter chord point location
e	elemental panel or lifting-surface designation
f	flap
g	ground
h	hinge
I	image
i	induced
L	lower surface
LA	left aileron
LE	leading edge
M	moment
P	pitching
R	root (geometry) or rolling (moment)
RA	right aileron
ref	reference dimensions
tab	trim-tab
TE	trailing-edge
U	upper surface
v	vortex-lift
Y	yawing

## LIST OF SYMBOLS (Continued)

### SUPERSCRIPTS:

$\rightarrow$	vector
'	alternate

### ABBREVIATIONS:

A.C.	aerodynamic center
C.G.	center of gravity
C.P.	center of pressure
L.E.	leading edge
MAC	mean aerodynamic chord
MGC	mean geometric chord
NCD	number of chord discontinuities
NCE	number of chord elements
NSE	number of span elements
T.E.	trailing edge

## 1.0 PROGRAM ABSTRACT

PROGRAM NUMBER: HA010B (N.SURFACE)  
PROGRAM TITLE: TRW Vortex-Lattice Method Subsonic Aerodynamic  
Analysis for Multiple-Lifting-Surfaces  
TAPE NUMBER: T00078 or A10202  
STATUS: Production  
LANGUAGE: Fortran V  
SYSTEM: UNIVAC 1108/CDC 6500 Computer  
CORE STORAGE REQUIREMENTS: Approximately 50K words  
TYPICAL EXECUTION TIME: 2 to 5 minutes per case (UNIVAC 1108)  
DESCRIPTION:

The aerodynamic airload distribution and spatially-integrated force and moment coefficients are calculated for single- or multiple-lifting-surface configuration by an improved vortex-lattice method developed by TRW. In this method, the influence of each surface is represented by a network of concentrated line vortices distributed on the surfaces and behind the surface-trailing-edges. The strength or circulation of these vortices is determined by the requirement that the flow be parallel to each surface at a discrete number of boundary control points or collocation points that is equal to the number of unknown vortex strengths. The treatment of the control point boundary conditions incorporated in the analysis (TRW's) is based on the exact surface geometry, i.e., no linearization or other usual simplifying assumptions are made. This feature makes it possible to perform more accurate calculations for general non-planar lifting surface configurations. The effect of the leading-edge flow separation on the airload coefficients for theoretically sharp leading-edges is evaluated by an approximate technique based on the vortex-lift leading-edge suction analogy. Numerical solutions can be performed including as many as 200 separate vortex filaments or elemental surfaces for symmetric and 100 for unsymmetric aerodynamic loadings respectively. The extension of the incompressible solutions to compressible flows ( $0 < M < 1$ ) is accomplished via the Prandtl-Glauert transformation. Flight over a ground plane is calculated by the method of images as a special option of the program.

The output consists of data presented for ready engineering use such as pressure distributions, section coefficients, and spatially-integrated coefficients. Exact numerical solutions or arrays of solutions extrapolated using the lifting line theory from two or more exact vortex-lattice solutions may be output for multiple and single-lifting-surfaces respectively. Other program features include: double precision matrix inversion, 4060-microfilm or Calcomp output, short or long print-format output, etc. An outline of the program analysis and execution options is presented in Pages 1-2 through 1-3.

## PROGRAM ABSTRACT (Contd.)

### ANALYTICAL MODEL FEATURES AND EXECUTION OPTIONS OUTLINE

#### ANALYSIS

- The aerodynamic airload distributions on single- or multiple-lifting surface configurations are calculated by an improved (TKW's) vortex-lattice method.
- The treatment of the control points is based on the exact geometry of the lifting surfaces, i.e., none of the usual linearization or other simplifying assumptions in the literature are incorporated in the analysis.
- The effect of leading-edge flow separation for theoretical-sharp leading edges (i.e., vortex-lift) is calculated by an approximate technique based on leading-edge suction analogy.
- Compressibility effects are accounted for via the Prandtl-Glauert transformation.
- Ground effects are calculated by the method of images that provides for exact analytical solutions for a flat ground plane of infinite extent, i.e., the boundary conditions of parallel flow at the ground plane are exactly satisfied.
- Arrays of solutions may be extrapolated from two exact vortex-lattice solutions by a method procedure based on the lifting-line theory.

#### VEHICLE CONFIGURATIONS

(See Table 1.01, Page 1-4)

- Single Surface: (XQT ISURF Option)  
A single surface of any configuration, shape, or form with or without severe surface discontinuities may be considered. This includes lifting surface configurations with flaps, ailerons, slots, with or without camber.
- Multiple Surfaces: (XQT NSURF Option)  
Up to five separate lifting surfaces of any configuration, shape, or form can be considered simultaneously. In each surface the effect of severe surface discontinuities can be considered in the same manner as outlined above for the single surface analysis. Multiple-lifting-surface configurations that may be analyzed include: wing-tail-fins, canard-wing-fins, thick-wing, lifting-body, and many other configurations. The complexity of the configurations that may be successfully analyzed depends on the maximum number of elemental panels or control points that can be considered simultaneously, i.e., 200 for symmetric and 100 for unsymmetric loadings respectively.

## PROGRAM ABSTRACT (Contd.)

### OUTPUT OPTIONS

- Printed Output
  - 1) Short-Print: the surface geometry, the airload force and pitching moment section coefficients, and all the force and moment spatially-integration airload coefficients are output for each of the lifting surfaces considered.
  - 2) Long-print: the short-print output, and the details of the lift (pressure coefficient) and vorticity distribution on each of the lifting surfaces considered are output.
  - 3) Debug-Print: the long-print output plus the details of the induced velocities and influence coefficients are output.
- Tape Output
  - 1) The lifting surface vortex-lattice geometry, section aerodynamic coefficients, etc. that are calculated in obtaining solutions are output on magnetic tape in the format required for executing the TRW plotting option, or
  - 2) By executing the plotting option (TRWPLT) included in the program, 4060-microfilm or Calcomp plots output of solutions (#1 above) can be obtained directly.

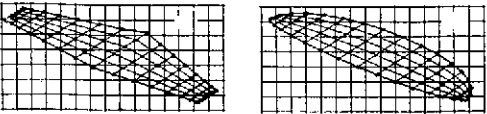
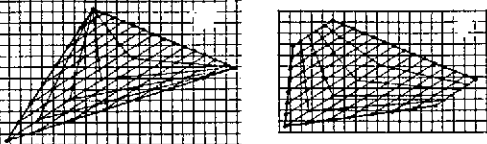
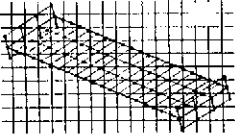
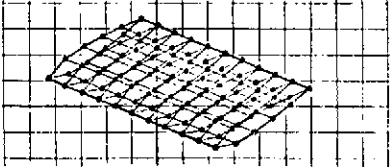
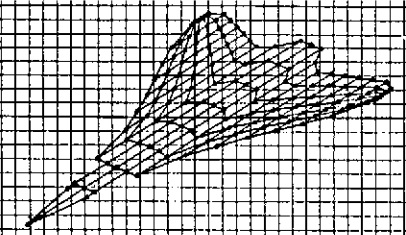
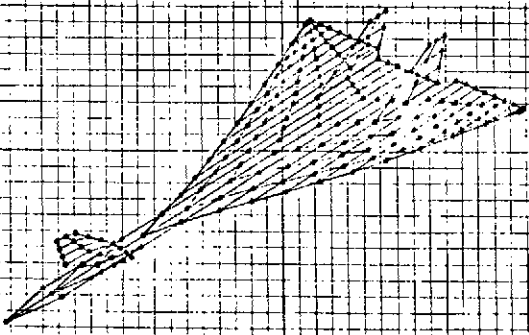
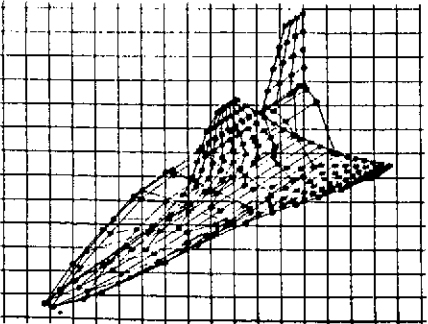
### SPECIAL OPTIONS

- Ground effects: flight in the presence of a very near ground plane may be calculated.
- Lifting-Line: arrays of solutions may be obtained by extrapolation from two exact vortex-lattice solutions using a method based on the lifting-line theory. This option at present (HA010B) is available only for single-lifting-surface configurations.

### EXECUTION TIME

- Symmetric loadings: about one minute per vortex-lattice solution for 100 elements.
- Unsymmetric loadings: about four minutes per vortex-lattice solution for 100 elements.
- With ground effects: about twice the time required for out-of-ground.
- Lifting-line arrays: about 1/2 minute extra running time.
- Maximum time: about four minutes and eight minutes per vortex-lattice solutions of out-of-ground and in-ground problems. The running times are based on 200 and 100 vortex-lattice elements for symmetric and unsymmetric loadings respectively.

TABLE 1.01 - REPRESENTATIVE LIFTING-SURFACE PROBLEMS OF VARIOUS CONFIGURATIONS THAT CAN BE SUCCESSFULLY SOLVED USING THE TRW VORTEX-LATTICE ANALYSIS PROGRAM NO. HA010B

VORTEX-LATTICE CONFIGURATION	NUMBER OF ELEMENTAL PANELS	EXECUTION TIME PER CASE	EVALUATION OF RESULTS
	80	34 sec	TYPE: THIN-SURFACE PROBLEM: WINGS OF AR = 6 RESULTS: VERY SUCCESSFUL DIFFICULTY: NONE
	70	30 sec	TYPE: THIN-SURFACE PROBLEM: WINGS OF LOW AR RESULTS: VERY SUCCESSFUL DIFFICULTY: NONE
	72	31 sec	TYPE: THIN-SURFACE PROBLEM: WING WITH END PLATES RESULTS: SATISFACTORY DIFFICULTY: SEVERE DISCONTINUITY
	100	42 sec	TYPE: THICK-SURFACE PROBLEM: WING THICKNESS RESULTS: VERY SUCCESSFUL DIFFICULTY: NONE
	112	63 sec	TYPE: THIN-SURFACE PROBLEM: DOUGLAS F5D-1 AIRPLANE RESULTS: VERY SUCCESSFUL DIFFICULTY: NONE
	162	98 sec	TYPE: THIN-SURFACE PROBLEM: NORTH AMERICAN XB-70 RESULTS: VERY SUCCESSFUL DIFFICULTY: NONE
	172	120 sec [vert. fin omitted]	TYPE: LIFTING-BODY PROBLEM: NASA-MSC #040A ORBITER RESULTS: NOT SUCCESSFUL DIFFICULTY: THE NUMBER OF ELEMENTAL PANELS THAT CAN BE CONSIDERED SIMULTA- NEOUSLY IS INSUFFICIENT TO PROVIDE VALID SOLUTIONS. BY NEGLECTING THE FUSELAGE THICKNESS THE THIN-SURFACE REPRESENTATION WAS APPLIED TO THIS PROBLEM VERY SUCCESSFULLY.

## 2.0 ANALYSIS

### 2.1 Analytical Procedures Review

It is a well known fact in aerodynamic theory that any surface, whether part of a body of finite thickness or merely an infinitesimally thin sheet, may be represented by a sheet of vorticity bound on the surface and a trailing vortex sheet shed behind the trailing edge. The velocity at any point in the flow field is the sum of the velocity vector induced by the vortex sheets and the free stream velocity vector. The strength of the vorticity representing the surface is determined by the requirement that the velocity vector computed as the sum of velocity induced by the vortex sheets and the free stream, be parallel to the surface. The strength of the trailing edge vortex sheet is determined from the surface bound vortex sheet strength using the conservation of vorticity laws for steady flow (i.e., Helmholtz vorticity laws) together with the requirement that there be no force exerted on the sheet, which means that the trailing edge vortex sheet must be everywhere parallel to the streamlines of the flow<sup>(1,2,3)†</sup>.

In the vortex lattice method, the influence of the surface is represented by a network of concentrated line vortices, distributed on the surface and behind the trailing edge<sup>(4,5)</sup>. The strength of these vortices is determined by the requirement that the flow be parallel to the surface at a number of boundary point or co-location points which are equal to the number of unknown vortex strengths. The location of the trailing vortices must be assumed, and thus may not happen to be exactly parallel to the streamlines. However, the path of the vortex sheet behind the wing may be guessed beforehand with fairly good accuracy, and since, in most instances, the results are not strongly influenced by the assumed path of the trailing vortices, excellent results of high accuracy are usually obtained<sup>(6)</sup>.

### 2.2 Vortex-Lattice Equations

The vortex lattice network arrangement used in the present analysis is illustrated in Figure 2.01<sup>‡</sup>. As shown in the figure, the wing surface is divided uniformly into a number of elemental panels of approximately equal size. The vorticity on the upper and lower surfaces of each panel is represented by a

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†Superscript in parenthesis denote references listed in Section 8.

‡Figures and Tables of this section are found at the end of the section.



single bound vortex line which is located in accordance with 2-D theory at the 1/4 chord of the panel<sup>(7)</sup>. The location of the control point or co-location point is arbitrary and is usually selected at the mid point between adjacent vortex lines which corresponds to the 3/4 chord of the panel. Since the vortex filaments cannot be discontinuous, the bound vortices for each panel are bent at both ends forming a pair of trailing vortices which must extend to infinity. In this manner these vortices represent the vorticity in the trailing edge vortex sheet. The bound vortex at the 1/4 chord of the panels and the pair of trailing vortex filaments define a generalized skew-shaped (oblique) horseshoe vortex filament of strength  $\Gamma$ . The number of horseshoe vortex filaments is equal to the number of panels or control points. The velocity at the control points is by definition parallel to the surface, and hence, the corresponding normal velocity components to the surface are exactly equal to zero. This boundary condition when applied to the jth panel is given by

$$(\vec{1N}_j) \cdot \left( \frac{\vec{V}_\infty}{V_\infty} + \sum_{k=1}^K \frac{\Gamma_k/V_\infty}{4\pi} \vec{\psi}_{k(j)} \right) = 0 \quad (2.2.01)$$

where:

- $\vec{1N}_j$  = the unit vector normal to the surface at the jth control point,
- $\vec{V}_\infty$  = the free stream velocity vector,
- $V_\infty$  = the scalar magnitude of the free stream velocity vector,
- $\Gamma_k$  = the strength of circulation of the kth panel horseshoe vortex filament,
- $\vec{\psi}_{k(j)}$  = the induced velocity vector influence function of the kth panel horseshoe vortex evaluated at the jth control point,
- $K$  = the total number of panels for all the lifting surfaces considered.

The induced velocity vector and influence vector functions are calculated in accordance with the induced velocity law of Biot and Savart<sup>(2,3)</sup>. Using the geometry convention for a representative horseshoe vortex shown in Figure 2.02, it follows

$$\frac{\vec{v}_1(j)}{v_\infty} = \sum_{k=1}^K \frac{\Gamma_k/v_\infty}{4\pi} \vec{\psi}_{k(j)} \quad (2.2.02)$$

$$\vec{\psi}_{k(j)} = \oint \frac{d\vec{\ell} \times (\vec{r} - \vec{r}')}{|\vec{r} - \vec{r}'|^3} \quad (2.2.03)$$

The calculation of the vector influence functions  $\vec{\psi}(j)$  are somewhat tedious but straightforward. In the present analysis the trailing vortices are assumed to be straight lines which extend to infinity and which are oriented at an angle  $\alpha/2$  in the manner shown in Figure 2.02. In this instance the bound vortex and trailing vortices for each panel form a generalized skew-shaped horseshoe vortex of the same configuration analysed in References 8 and 9. Analytical solutions for the vector influence functions are presented in Section 2.3. The number of unknown horseshoe filament circulation strengths  $\Gamma_k$  are equal to the number of boundary condition equations for the control points. Using matrix notation, these boundary conditions which were given in Equation 2.2.01, become

$$[A_j] + \left[ \frac{\Gamma_k}{v_\infty} \right] \times [B_{j,k}] = 0 \quad (2.2.04)$$

By inverting the matrix  $[B_{j,k}]$ , the unknown circulation strengths  $\Gamma_k$  are obtained

$$\left[ \frac{\Gamma_k}{v_\infty} \right] = - [A_j] \times \{ [B_{j,k}] \}^{-1} \quad (2.2.05)$$

In the presence of a ground plane, exact analytical solutions are obtainable by the method of images by assuming the ground plane to be perfectly flat and of infinite extent. Under these conditions, the boundary requirement for the flow at the ground plane is exactly satisfied by defining a mirror image of the vortex lattice directly below at a distance equal to twice the altitude from the ground plane. The calculation of the induced velocity (Equation 2.2.02) is modified to include the effect of the image vortex lattice influence coefficients as follows

$$\frac{\vec{V}_I(j)}{V_\infty} = \sum_{k=1}^K \frac{\Gamma_k/V_\infty}{4\pi} \left[ \vec{\psi}_{k(j)} - \vec{\psi}_{k(j)}^I \right] \quad (2.2.06)$$

$\vec{\psi}_{k(j)}^I$  = the influence function of the image vortex lattice.

Note that in the present formulation, none of the usual linearization or other simplifying assumptions were made on the boundary conditions at the control points (e.g., References 10 and 11). Therefore, severe variations in lifting surfaces planform such as twist, camber, dihedral, etc. are treated exactly and more accurate solutions may be obtained.

### 2.3 Influence Coefficients

Consider the straight vortex-filament element of length  $\Delta S$  that is illustrated in Figure 2.03. In computing the induced velocity vector for the vortex filament at a field point  $P(0,Y,Z)$ , the influence coefficient is obtained by integrating Equation 2.2.03 within the appropriate boundary conditions described in the figure. It follows

$$\Delta \vec{V} = \frac{\Gamma}{4\pi} \vec{\Delta \psi} \quad (\text{the induced velocity}) \quad (2.3.01)$$

$$\vec{\Delta \psi} = \vec{1V} \Delta \psi \quad (\text{the influence coefficient}) \quad (2.3.02)$$

where  $\vec{1V}$  and  $\Delta \psi$  are a unit vector and a scalar quantity, respectively. These are given by

$$\vec{1V} = - \vec{1AQ} \times \vec{1QP} = - \frac{Z}{R} \vec{1Y} + \frac{Y}{R} \vec{1Z} \quad (2.3.03)$$

$$\Delta \psi = \frac{1}{R} \left[ \frac{h + \Delta S}{\sqrt{(h + \Delta S)^2 + R^2}} - \frac{h}{\sqrt{h^2 + R^2}} \right] \quad (2.3.04)$$

$$R = \sqrt{Y^2 + Z^2} \quad (2.3.05)$$

The above equations can be used to determine the influence coefficient vector for any field point  $P(X,Y,Z)$  of any complex-shaped filament if it is assumed that it is composed of a discrete number of rectilinear increments  $\Delta L$  (illustrated in Figure 2.03) and by performing the appropriate coordinate transformations. For the generalized skew-shaped vortex filament in Figure 2.02,

the calculation of the influence coefficient vector for any flow field  $P(X,Y,Z)$  is performed in this manner. Making use of the localized coordinate system in Figure 2.04, the shape of the skew-shaped vortex filament is prescribed by the coordinates of points B-D given by

$$B = B(-c, -a, -d) \quad (2.3.06)$$

$$D = D(c, a, d) \quad (2.3.07)$$

$$c = a \tan(\Lambda) \quad (2.3.08)$$

$$d = a \tan(\phi) \quad (2.3.09)$$

If the vortex filament is broken into three elements, i.e.,  $\infty$ -A-B, D-E- $\infty$ , and B-C-D, the influence coefficient vector for the filament is equal to the sum

$$\vec{\psi} = \sum_{i=1}^3 \vec{1V}_i \Delta\psi_i \quad (2.3.10)$$

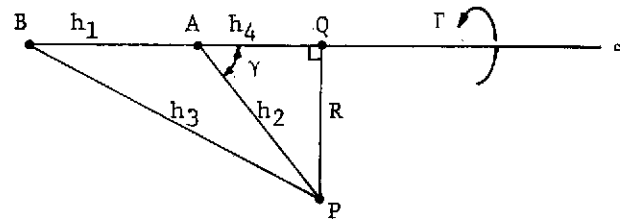
#### Segment #1 ( $\infty$ -A-B)

The contribution of segment #1 for an arbitrary field point  $P(X,Y,Z)$  is calculated as follows. The coordinates of point A are given by

$$A = A(X, -a, -d') \quad (2.3.11)$$

$$d' = d + (X + c) \tan(\alpha/2) \quad (2.3.12)$$

and making use of the geometry according to the sketch below,



$$h_1 = \sqrt{(X + c)^2 + (d' - d)^2} \quad (2.3.13a)$$

$$h_2 = \sqrt{(Y + a)^2 + (Z + d)^2} \quad (2.3.13b)$$

$$h_3 = \sqrt{(X + c)^2 + (Y + a)^2 + (Z + d)^2} \quad (2.3.13c)$$

$$\cos (\gamma) = - \frac{h_1^2 + h_2^2 - h_3^2}{2h_1 h_2} \quad (2.3.13d)$$

$$R = h_2 \sqrt{1 - (\cos \gamma)^2} \quad (2.3.13e)$$

$$h_4 = h_2 \cos (\gamma) \quad (2.3.13f)$$

Using Equation 2.3.04, the scalar part of the influence coefficient can now be computed

$$\Delta \psi_1 = \frac{1}{R} \left[ 1 + \frac{h_1 + h_4}{\sqrt{(h_1 + h_4)^2 + R^2}} \right] \quad (2.3.14)$$

The calculation of the vector part of the influence coefficient will be considered next. The coordinates of point Q shown on the sketch are

$$Q = Q(X_q, Y_q, Z_q) \quad (2.3.15a)$$

$$X_q = -c + (h_1 + h_4) \cos (\alpha/2) \quad (2.3.15b)$$

$$Y_q = -a \quad (2.3.15c)$$

$$Z_q = -d - (h_1 + h_4) \sin (\alpha/2) \quad (2.3.15d)$$

and the unit vectors for the line segments B-Q and Q-P can now be calculated

$$\vec{1BQ} = \vec{1X} \cos (\alpha/2) - \vec{1Z} \sin (\alpha/2) \quad (2.3.16)$$

$$\vec{1QP} = \vec{1X} \left( \frac{X - X_q}{R} \right) + \vec{1Y} \left( \frac{Y - Y_q}{R} \right) + \vec{1Z} \left( \frac{Z - Z_q}{R} \right) \quad (2.3.17)$$

then, the vector part of the influence coefficient, i.e., a unit vector, is given by the vector cross-product

$$\vec{1V}_1 = \vec{1BQ} \times \vec{1QP} \quad (2.3.18)$$

Segment #2 (D-E- $\infty$ )

The contribution of segment #2 for the same arbitrary field point P(X,Y,Z) is calculated in the same manner as outlined for segment #1; specifically, Equations 2.3.19 through 2.3.23 are used in place of 2.3.11, 2.3.12, 2.3.13, and 2.3.15 respectively, where

$$E = E(X, a, +d') \quad (2.3.19)$$

$$d' = d - (X - c) \tan(\alpha/2) \quad (2.3.20)$$

$$h_1 = \sqrt{(X - c)^2 + (d - d')^2} \quad (2.3.21a)$$

$$h_2 = \sqrt{(Y - a)^2 + (Z - d)^2} \quad (2.3.21b)$$

$$h_3 = \sqrt{(X - c)^2 + (Y - a)^2 + (Z - d)^2} \quad (2.3.21c)$$

$$X_q = c + (h_1 + h_4) \cos(\alpha/2) \quad (2.3.22a)$$

$$Y_q = a \quad (2.3.22b)$$

$$Z_q = d - (h_1 + h_4) \sin(\alpha/2) \quad (2.3.22c)$$

$$\vec{1V}_2 = -\vec{1DQ} \times \vec{1QP} \quad (2.3.23a)$$

$$\vec{1DQ} = \vec{1BQ} \quad (2.3.23b)$$

### Segment #3 (B-C-D)

The contribution of segment #3 for the same arbitrary field point P(X,Y,Z) considered for segments #1 and #2 is calculated in a like manner as outlined in detail for segment #1. For segment #3, the coordinates of points B(-c,-a,-d) and D(c,a,d) are used to determine the solutions for

$$h_1 = 2 \sqrt{c^2 + a^2 + d^2} \quad (2.3.24a)$$

$$h_2 = \sqrt{(X - c)^2 + (Y - a)^2 + (Z - d)^2} \quad (2.3.24b)$$

$$h_3 = \sqrt{(X + c)^2 + (Y + a)^2 + (Z + d)^2} \quad (2.3.24c)$$

$$\cos(\gamma) = - \frac{h_1^2 + h_2^2 - h_3^2}{2h_1 h_2} \quad (2.3.24d)$$

$$h_4 = h_2 \cos(\gamma) \quad (2.3.24e)$$

$$R = h_2 \sqrt{1 - (\cos \gamma)^2} \quad (2.3.24f)$$

and using Equation 2.3.04, the scalar part of the influence coefficient for segment #3 (B-D) can now be computed

$$\Delta\psi_3 = \frac{1}{R} \left[ \frac{h_1 + h_4}{\sqrt{(h_1 + h_4)^2 + R^2}} - \frac{h_4}{\sqrt{h_4^2 + R^2}} \right] \quad (2.3.25)$$

Next, to calculate the vector part of the influence coefficient the coordinates of point Q(X<sub>q</sub>,Y<sub>q</sub>,Z<sub>q</sub>) must be calculated first. Accordingly

$$X_q = c + h_4 (2c/h_1) \quad (2.3.26a)$$

$$Y_q = a + h_4 (2a/h_1) \quad (2.3.26b)$$

$$z_q = d + h_4 (2d/h_1) \quad (2.3.26c)$$

The unit vectors  $\vec{1BQ}$  and  $\vec{1QP}$  are given by

$$\vec{1BQ} = \vec{1X} \left( \frac{2c}{h_1} \right) + \vec{1Y} \left( \frac{2a}{h_1} \right) + \vec{1Z} \left( \frac{2d}{h_1} \right) \quad (2.3.27)$$

$$\vec{1QP} = \vec{1X} \left( \frac{X - X_q}{R} \right) + \vec{1Y} \left( \frac{Y - Y_q}{R} \right) + \vec{1Z} \left( \frac{Z - Z_q}{R} \right) \quad (2.3.28)$$

from which the vector part of the influence coefficient, i.e., the unit vector  $\vec{1V}_3$ , can be calculated by simply taking the vector cross-product

$$\vec{1V}_3 = - \vec{1BQ} \times \vec{1QP} \quad (2.3.29)$$

#### 2.4 Exact-Theory Aerodynamic Forces and Moments

The net aerodynamic force vector exerted on the jth panel (i.e., jth elemental surface) is calculated using

$$\frac{\vec{F}_j}{\rho_\infty V_\infty^2} = \frac{\left( \frac{\vec{V}_j}{V_\infty} \times \vec{\Delta L}_j \right) \frac{\Gamma_j}{V_\infty}}{\beta} \quad (2.4.01)$$

$$\frac{\vec{V}_j}{V_\infty} = \frac{\vec{V}_\infty}{V_\infty} + \sum_{k=1}^K \frac{\Gamma_k / V_\infty}{4\pi} \vec{\psi}_{k(j)} \quad (2.4.02)$$

where

$\vec{\Delta L}_j$  = the length vector of the bound vortex filament of the panel,

$\vec{V}_j$  = the velocity vector computed as the sum of free stream and induced velocity vectors evaluated at the midpoint of the bound vortex of the jth panel,

$\beta$  = the Prandtl-Glauert compressibility factor, =  $\sqrt{1 - M_\infty^2}$



$\vec{\psi}_{k(j)}$  = the vector influence function of the kth panel evaluated at midpoint of the jth bound vortex.

The force vector  $\vec{F}_j$  is assumed to act at the midpoint of the bound vortex filament of the kth panel. The corresponding section aerodynamic load coefficients and integrated wing force and moment coefficients are obtained by the appropriate summation of the forces  $\vec{F}_j$  acting on each panel. In determining these quantities the following relations derived from the exact analysis are used

#### Force Coefficients for jth Panel

$$c_{F_{X,j}} = 2 \left( \frac{\vec{F}_j / (\rho_\infty v_\infty^2)}{\Delta S_j} \right) \cdot (\vec{1X}) \quad (2.4.03)$$

$$c_{F_{Y,j}} = 2 \left( \frac{\vec{F}_j / (\rho_\infty v_\infty^2)}{\Delta S_j} \right) \cdot (\vec{1Y}) \quad (2.4.04)$$

$$c_{F_{Z,j}} = 2 \left( \frac{\vec{F}_j / (\rho_\infty v_\infty^2)}{\Delta S_j} \right) \cdot (\vec{1Z}) \quad (2.4.05)$$

#### Differential Pressure Coefficients

$$(c_{p_L} - c_{p_U})_j = 2 \left| \left( \frac{\vec{F}_j / (\rho_\infty v_\infty^2)}{\Delta S_j} \right) \right| \quad (2.4.06)$$

#### Lifting Surface Section Airload Coefficients

For each lifting surface, by summing up the appropriate force contributions,

$$c_{n(Y)} = - \frac{1}{C} \sum c_{F_{Z,j}} \frac{\Delta S_j}{\Delta Y_j} \Big|_Y \quad (2.4.07)$$

$$c_{t(Y)} = - \frac{1}{C} \sum c_{F_{X,j}} \frac{\Delta S_j}{\Delta Y_j} \Big|_Y \quad (2.4.08)$$

$$c_{m(Y)} = \frac{1}{C^2} \sum \left[ c_{F_{Z,j}} \frac{\Delta S_j}{\Delta Y_j} (x_j - x_{(C/4)}) + c_{F_{X,j}} \frac{\Delta S_j}{\Delta Y_j} (z_j - z_{(C/4)}) \right] \Big|_Y \quad (2.4.09)$$

$$c_{l(Y)} = c_{n(Y)} \cos(\alpha) + c_{t(Y)} \sin(\alpha) \quad (2.4.10)$$

$$c_{d_1(Y)} = -c_{t(Y)} \cos(\alpha) + c_{n(Y)} \sin(\alpha) \quad (2.4.11)$$

#### Lifting Surface Spatially-Integrated Airload Coefficients

$$C_N = -\frac{1}{S} \sum_j c_{F_{Z,j}} \Delta S_j \quad (2.4.12)$$

$$C_T = -\frac{1}{S} \sum_j c_{F_{X,j}} \Delta S_j \quad (2.4.13)$$

$$C_{M_{P(\bar{C}/4)}} = \frac{1}{S \bar{C}} \sum_j \Delta S_j \left( c_{F_{Z,j}} x_{aj} - c_{F_{X,j}} z_{aj} \right) \quad (2.4.14)$$

$$C_{M_{R(\bar{C}/4)}} = \frac{1}{S \bar{C}} \sum_j \Delta S_j \left( c_{F_{Y,j}} z_{aj} - c_{F_{Z,j}} y_{aj} \right) \quad (2.4.15)$$

$$C_{M_{Y(\bar{C}/4)}} = \frac{1}{S \bar{C}} \sum_j \Delta S_j \left( c_{F_{Y,j}} x_{aj} - c_{F_{X,j}} y_{aj} \right) \quad (2.4.16)$$

$$C_L = C_N \cos(\alpha) + C_T \sin(\alpha) \quad (2.4.17)$$

$$C_{D_i} = -C_T \cos(\alpha) + C_N \sin(\alpha) \quad (2.4.18)$$

$$x_{aj} = x_j - x_{(\bar{C}/4)} \quad (2.4.19)$$

$$y_{aj} = y_j \quad (2.4.20)$$

$$z_{aj} = z_j - z_{(\bar{C}/4)} \quad (2.4.21)$$

In equations 2.4.07 through 2.4.16 the summations are performed over the vortex-lattice elemental surfaces that correspond to each lifting surface. To obtain the total force for the sum of N lifting surfaces, the summation is carried out over all the panels ( $j=1,J$ ) and the reference dimensions for the first lifting surface ( $n=1$ ) are used.

## 2.5 Approximate-Theory Aerodynamic Forces and Moments

In the preceding sections the procedure for obtaining exact solutions for the aerodynamic forces and moments by the vortex lattice method were developed. To generate an array of such solutions (for instance by varying the wing angle of attack) would be considered unwise because of the excessive computing time expenditure required. Instead, an array of approximate solutions of sufficient engineering accuracy may be obtained by extrapolation from two exact vortex lattice solutions by using the lifting line theory. Accordingly, for a single lifting surface, given two exact solutions obtained at two different angles of attack  $\alpha_1$ , and  $\alpha_2$ , the extrapolated solutions for any other angle of attack  $\alpha$  may be obtained in the following manner.

### Wing Lift Coefficient

$$\bar{m} = \frac{C_{L1} - C_{L2}}{\alpha_1 - \alpha_2} \quad (2.5.01)$$

$$\alpha R_o = \alpha_1 - \frac{C_{L1}}{\bar{m}} \quad (2.5.02)$$

$$C_L = \bar{m} (\alpha - \alpha R_o) \quad (2.5.03)$$

### Wing Moment Coefficients (Pitching, Rolling, and Yawing) about $\bar{C}/4$

$$C'_M = \frac{C_{M1} - C_{M2}}{C_{L1} - C_{L2}} \quad (2.5.04)$$

$$C_{M_o} = C_{M1} - C'_M C_{L1} \quad (2.5.05)$$

$$C_M = C_{M_o} + C'_M C_L \quad (2.5.06)$$

### Wing Section Lift Coefficients

$$c_{la1}(Y) = \frac{c_{l1}(Y) - c_{l2}(Y)}{C_{L1} - C_{L2}} \quad (2.5.07)$$

$$c_{lb}(Y) = c_{l1}(Y) - c_{la1}(Y) C_{L1} \quad (2.5.08)$$

$$c_{l(Y)} = c_{la1}(Y) C_L + c_{lb}(Y) \quad (2.5.09)$$

### Wing Section Induced Drag Coefficients

$$c_{di}'(Y) = \left( \frac{c_{di1} - c_{di2}}{c_{l1}^2 - c_{l2}^2} \right) (Y) \quad (2.5.10)$$

$$c_{di_o(Y)} = c_{di1(Y)} - c_{di}'(Y) c_{l1(Y)}^2 \quad (2.5.11)$$

$$c_{di(Y)} = c_{di_o} + c_{di}'(Y) c_{l(Y)}^2 \quad (2.5.12)$$

or using the lifting line theory exact results,

$$c_{di(Y)} = \left[ \frac{1}{\pi c_{la1}(Y)} - \frac{1}{2\pi} \right] c_{l(Y)}^2 \quad (2.5.13)$$

Equation 2.5.13 is recommended in the analysis of wing planforms of moderate aspect ratio and negligible sweep and dihedral angles.

### Wing Induced Drag Coefficient

$$C_{Di} = \frac{1}{S} \int_{-b/2}^{+b/2} c_{di(Y)} C_{l(Y)} dY \quad (2.5.14)$$

which when expressed as a function of  $C_L$  becomes

$$C_{Di} = C_{Di_o} + C_{Di1}' C_L + C_{Di2}' C_L^2 \quad (2.5.15)$$

The coefficients  $C_{D_{i_0}}$ ,  $C_{D_{i_1}}$  and  $C_{D_{i_2}}$  are constants which may be evaluated from three separate approximate solutions.

### Drag Due to Skin Friction

$$cd_f = 2 CF \quad (\text{CONSTANT}) \quad (2.5.16)$$

$$C_{D_f} = cd_f \quad (2.5.17)$$

where CF is the aerodynamic cleanness factor which is defined as

$$CF = \frac{\text{EQUIVALENT FLAT PLATE AREA}}{\text{WETTED AREA}} = \frac{C_{D_\pi} S_\pi}{2S} \quad (2.5.18)$$

The total drag coefficients are obtained as the sum of induced drag and skin friction drag for the wing section coefficients and the integrated wing coefficients respectively.

### 2.6 Vortex Lift

Experimental studies of sharp leading edge delta wings have shown that at even relatively low angles of attack the flow separates from the leading edge and rolls up into two vortex sheets or cone shaped cores of rotating fluid particles with the axes of rotation located approximately parallel to the leading edges<sup>(12,13)</sup>. In general, this vortex flow results in an increase in lift that is called vortex lift or non-linear lift, and an increase in drag resulting from the loss of leading edge suction. Although it is desirable to avoid the formation of the separated flow vortex sheets because of the high drag, it is a phenomenon which is always encountered by low aspect ratio highly swept wings operating near the stalling attitude. Furthermore, the separated vortex flow phenomenon is not restricted to this type of wing planform but is a general characteristic of all sharp leading-edge wings regardless of their leading-edge sweep angle.

The attached flow and separated vortex flow over blunt and sharp leading edge wings respectively are schematically illustrated in Figure 2.05. For the attached flow (blunt leading edges) there exists a net thrust force which is called the leading edge suction. This force may be interpreted to be

exerted by the bound vortex filaments at the leading edge. For sharp leading edges, attached flow cannot exist because of the infinitely large velocity and low pressure required, and therefore, the flow separates locally displacing the leading edge bound vortex filaments into the cavity formed by the separated flow. The vortex filaments in the cavity are not free vortices and therefore they will exert a net force in the normal direction to the wing surface because of the reorientation of the velocity vector.

Exact analytical solutions for sharp leading edge wings with leading edge separated flow are available in the published literature for a very restrictive range of wing geometries<sup>(14,15,16)</sup>. Usually these solutions are based on the assumption of conical flow, and as a consequence, only perfect delta wing planforms which feature no twist, no camber, and straight trailing edges can be considered. Therefore, in the prediction of the vortex lift for arbitrary sharp leading edge wing planforms, only empirical methods or approximate theory is available. The most successful analytical techniques are based on the vortex-lift leading-edge suction analogy. The method is based on the assumption that the vortex lift vector can be estimated from the leading edge thrust or suction force associated with the flow over the wing planform without separated flow at the leading edge. It follows (see Figure 2.05)

$$\Delta c_{n_v} = \frac{c_t}{\cos(\Delta_{LE})} \left( \frac{\alpha}{|\alpha|} \right) \quad (2.6.01)$$

$$\Delta c_{t_v} = -c_t \quad (2.6.02)$$

$$\Delta c_{m_v(c/4)} = -\Delta c_{n_v} \left( \frac{x_{LE} - x_{(c/4)}}{c} \right) \quad (2.6.03)$$

$$\Delta c_{l_v} = \Delta c_{n_v} \cos(\alpha) + \Delta c_{t_v} \sin(\alpha) \quad (2.6.04)$$

$$\Delta c_{d_v} = -\Delta c_{t_v} \cos(\alpha) + \Delta c_{n_v} \sin(\alpha) \quad (2.6.05)$$

These increments represent the force and moment coefficients due to the vortex lift which must be added to each lifting surface section coefficients in order to

obtain the net forces on the wing corresponding to the case of no leading edge suction. In the derivation of these relations, the vortex lift distribution has been assumed to act at the leading edge and normal to the wing chord plane.

Because of the approximate manner in which the leading edge suction thrust coefficient is calculated the evaluation for the vortex lift effects are only applicable to lifting surface planforms having a flat chord plane. Note that the thrust coefficient is calculated by integration of the forces in chordwise strips acting in all the bound vortices of the vortex-lattice matrix. Such an integration will provide accurate evaluations of the leading edge thrust if the chord plane is flat or if a very large number of chordwise rows are considered. If an infinite number of chordwise rows are considered, the vortex-lattice method will provide solutions equivalent to the potential flow solutions and an exact evaluation of the leading edge suction force will result. In the latter case, the leading edge suction thrust coefficient could be evaluated from the force exerted by a few of the leading edge bound vortices.

The spatially integrated wing coefficient increments due to the leading edge vortex lift are calculated from the wing section coefficient span distributions given in Equations 2.6.01 through 2.6.05, as follows

$$\Delta C_{L_v} = \frac{1}{S} \int_{-b/2}^{+b/2} \Delta c_{l_v} C \, dY \quad (2.6.06)$$

$$\Delta C_{D_v} = \frac{1}{S} \int_{-b/2}^{+b/2} \Delta c_{d_v} C \, dY \quad (2.6.07)$$

$$\Delta C_{M_{P,v}(\bar{C}/4)} = \frac{1}{S \bar{C}} \int_{-b/2}^{+b/2} \left[ - \Delta c_{n_v} (X_{LE} - X_{(\bar{C}/4)}) + \Delta c_{t_v} (Z_{LE} - Z_{(\bar{C}/4)}) \right] C \, dY \quad (2.6.08)$$

For obtaining approximate solutions of the vortex lift at selected wing angles of attack from two or more exact vortex lattice solutions, the following assumption is made which yields accurate results

$$\Delta c_{n_v}(Y, \alpha) = c_1(Y) + c_2(Y) \frac{\alpha^3}{|\alpha|} \quad (2.6.09)$$

$$\Delta c_{t_v}(Y, \alpha) = c_3(Y) + c_4(Y) \alpha^2 \quad (2.6.10)$$

The quantities  $c_1$ ,  $c_2$ ,  $c_3$ , and  $c_4$  are constants which are evaluated from the two vortex lattice solutions obtained at different angles of attack  $\alpha_1$  and  $\alpha_2$  in the manner described in Section 2.5.

## 2.7 Surface Discontinuities

Surface discontinuities occurring in the wing surface such as those encountered at the aileron-flap juncture cannot be treated exactly by the vortex lattice solution technique. Although by increasing the number of elements or control points the accuracy of the solutions should in principle be improved, sharp discontinuities in the surface may cause local oscillations on the solutions that become more severe as the number of elements are increased. To circumvent this problem, a cosine smoothing option whose effect is illustrated in Figure 2.06 has been adopted. The affected span length  $\delta$  is prescribed by the program user as an execution input. A value of 1/5 of the semispan is recommended. In addition, various other options for spacing the elements in the spanwise and chordwise directions have been made available. These include constant spacing, cosine spacing, and spacing prescribed as an execution input. For deflected control surfaces, a minimum of four elements of approximate equal size per chordwise row is recommended, the last element corresponding to the deflected surface.

The airload section coefficients for the flapped surfaces are calculated in a similar manner to the wing section coefficients (Section 2.4). By considering only the forces on the bound vortices on the flapped surfaces ( $x_j - x_{h,j}$ ) it follows

$$c_{n_f}(Y) = - \frac{1}{c_f} \sum c_{F_{z,j}} \left. \frac{\Delta S_j}{\Delta Y_j} \right|_{Y, (x_j - x_{h,j})} \quad (2.7.01)$$

$$c_{t_f}(Y) = - \frac{1}{c_f} \sum c_{F_{x,j}} \left. \frac{\Delta S_j}{\Delta Y_j} \right|_{Y, (x_j - x_{h,j})} \quad (2.7.02)$$



$$c_{h_f}(Y) = \frac{1}{c_f^2} \sum \left[ c_{F_{Z,j}} \frac{\Delta S_j}{\Delta Y_j} (x_j - x_{h,j}) + c_{F_{Z,j}} \frac{\Delta S_j}{\Delta Y_j} (z_j - z_{h,j}) \right]_{Y, (x_j - x_{h,j})} \quad (2.7.03)$$

$$c_{l_f}(Y) = c_{n_f}(Y) \cos(\alpha) + c_{t_f}(Y) \sin(\alpha) \quad (2.7.04)$$

$$c_{d_{1,f}}(Y) = -c_{t_f}(Y) \cos(\alpha) + c_{n_f}(Y) \sin(\alpha) \quad (2.7.05)$$

For obtaining approximate solutions (see Section 2.5) the following assumptions are made

$$c_{l_f}(Y, \alpha) = F_1(Y) + F_2(Y) \alpha \quad (2.7.06)$$

$$c_{d_{1,f}}(Y, \alpha) = F_3(Y) + F_4(Y) (c_{l_f}(Y, \alpha))^2 \quad (2.7.07)$$

$$c_{h_f}(Y, \alpha) = F_5(Y) + F_6(Y) \alpha^2 \quad (2.7.08)$$

The quantities  $F_1, F_2, \dots, F_6$  are constants which are evaluated from two exact vortex lattice solutions obtained at different angles of attack  $\alpha_1$  and  $\alpha_2$ .

## 2.8 Lift in the Presence of a Fuselage

Two options for calculating the lift in the presence of a generalized cylindrical-shaped fuselage are possible:

### 1) Analytical Method - Circular Shaped Fuselage

In this method the effect of a circular shaped fuselage of radius  $R$  and of infinite length is analyzed by the method of images. According to the hydrodynamic theory, the boundary conditions of zero normal flow to the fuselage surface due to wing trailing vortices are satisfied by defining a pair of vortex filament images inside the fuselage. Since the free stream velocity vector is neglected in satisfying the boundary conditions on the fuselage, only approximate solutions which are valid at small angles of attack are obtainable (i.e., the fuselage attitude is oriented parallel to the wing trailing vortices). Using cylindrical coordinates with the axis of symmetry located at the center of the fuselage, the location of the pair of images

for a wing trailing vortex filament is determined from

$$\begin{array}{ll} \text{Image \# 1} & \text{Image \# 2}^{\dagger} \\ X_I = X & X_I = X \end{array} \quad (63)$$

$$\begin{array}{ll} \vec{r}_I = \vec{r} \left( \frac{R}{|\vec{r}|} \right)^2 & \vec{r}_I = 0 \end{array} \quad (64)$$

$$\begin{array}{ll} \Gamma_I = -\Gamma & \Gamma_I = \Gamma \end{array} \quad (65)$$

where  $\left. \begin{array}{l} X \\ r \\ \Gamma \end{array} \right\}$  the coordinates and circulation strength at a point in a wing trailing vortex filament.

The calculation of the induced velocity of the pair of images is performed by integration in the manner outlined in Section 2.3 from which the calculation of the induced velocity vector influence functions follows.

The effect of the presence of a circular shaped fuselage on the wing bound vortices cannot be determined by exact analysis except under very restrictive assumptions for the wing geometry. Therefore, a relatively simple and approximate approach has to be adopted. The effect of the presence of the fuselage on the velocity induced by the bound vortices is assumed to be the same as its effect on a two-dimensional uniform rectilinear flow. Thus, the velocity component induced by the bound vortices at some point P in the flow field is increased by a factor

$$\left[ 1 + \left( \frac{R}{|\vec{r}_{(P)}|} \right)^2 \right] \quad (2.8.04)$$

which is an exact correction for a straight and infinite bound vortex line intersecting the cylinder axis of symmetry at 90°. The approximation will be valid for wings having small sweepback angles and slender fuselages centered at the wing axis of symmetry.

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<sup>†</sup>The sum of the contribution of images #2 will be zero for symmetric wing loadings.

## 2) Vortex-Lattice Method - Arbitrary Shaped Fuselage

The effect of the presence of an arbitrary shaped fuselage on the wing lift can be calculated using the vortex lattice method.<sup>†</sup> The accuracy of the solutions that are obtained depends on the selection of the number of control points and their location on the fuselage surface. For accurate calculation of the fuselage it would probably require an equal or larger number of control points on the fuselage surface than the number used for the wing. The main advantages of using the vortex-lattice method in preference to other analytical methods (e.g., the method of images) are: (1) non-planar wings of arbitrary planform may be analyzed, (2) no restriction is placed on the cross section, length or shape of the fuselage, and (3) the accuracy desired for obtaining solutions can be obtained by increasing the number of panels or by varying the location of the control points at the surface of the fuselage. In the present vortex-lattice program (HA010B), the treatment of exact fuselage-wing vehicle configurations is severely limited by the total number of elemental vortex-filament surfaces (about 100) that can be considered simultaneously. At present, only by an approximate representation of the fuselage (e.g., by defining an equivalent flat surface) can the fuselage-wing configurations be analyzed by the program.

### 2.9 Program Qualification Tests

The vortex lattice method is suitable for determining accurate solutions for the aerodynamic loads on lifting surfaces of arbitrary planforms. Nevertheless, for conventional wing planforms featuring negligible dihedral and small camber, generally more exact analytical solution methods based on the integral lifting surface<sup>(7)</sup> and lifting line theories<sup>(16)</sup> are available. These solutions and equivalent experimental test results have been used to demonstrate the accuracy of the present vortex-lattice analytical method.<sup>(8)</sup> For wing planforms with severe surface discontinuities, only comparisons

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<sup>†</sup>It is a well known fact in hydrodynamic theory that the presence of arbitrary bodies immersed in a steady subsonic or supersonic flow field can be represented by distributions of sources and sinks inside the volume occupied by the bodies. Mathematically, the distributions of sources and sinks may be replaced by distributions of doublets or vortex filaments located on the surface of the bodies. If the vortex filament representation is adopted (i.e., the vortex lattice method), a rectangular vortex ring for each panel in the surface of the bodies is defined with the corresponding control points located at the center of each panel.

against available experimental test results can be performed. In general it should be noted that: (1) the vortex lattice solutions are affected by the number of surface elements, the location of the control points, and the geometric arrangement of the vortex lattice network which are input quantities prescribed by the program users, (2) for conventional wing planforms with moderate aspect ratio and moderate dihedral and sweepback angles, the lifting line methods will provide more accurate solutions, and (3) when the wing surface is placed very near a ground plane, large differences in the span and chord lift distributions in comparison with out-of-ground conditions occur; therefore, ground effects can only be properly analyzed by the integral lifting surface or the vortex lattice method. In the lifting line method the local section aerodynamic characteristics are assumed to depend only on the airfoil section properties for two dimensional flow (i.e., infinite aspect ratio) which are generally determined from wind tunnel tests.<sup>(17, 18)</sup> In the presence of a very near ground plane this assumption is not valid.

#### 2.9.1 Vortex-Lattice Geometry and Control Point Locations

The effect of varying the vortex lattice geometric arrangement for a fixed wing planform on the solution of the spatially integrated wing airload coefficients is demonstrated in Table 2.01. Predictions are presented for a delta wing planform of aspect ratio of two. Both constant spacing and cosine spacing of the elements in the spanwise and chordwise directions are considered. Nevertheless, the differences between solutions on the integrated wing coefficients is found to be negligible, i.e., within one percent. On the other hand, the variation of the vortex lattice arrangement due to constant and variable (cosine) spacing of the elements shows a significant effect on the predictions for the spanwise section lift distribution in the region near the wing tip (see Figure 2.07). Based on the results presented, it is concluded that constant span spacing of the elements provides more reasonable solutions than variable spacing for wings of low aspect ratio ( $\sim 2$ ). For moderate to high aspect ratio wings, the opposite is found to be true. As a general rule, accurate solutions are obtained by selecting not less than ten spanwise elements and not less than four chordwise elements. The spacing of the elements should be such that adjacent elements have approximately equal size and equal configuration. Furthermore, the accuracy of the predicted spatially integrated wing coefficients depends primarily on the total number

of elements considered, i.e., errors in the calculated local airload coefficients will cancel out in the integration process.

The effect of varying the control point locations on the wing integrated airload coefficients for a delta wing of aspect ratio of two is presented in Table 2.02. As shown in the table, by moving the control points aft of the  $3/4$  chord of the panels, an increase in the wing airloads and a forward shift of the center of pressure results. Similar conclusions are drawn for wings of moderate aspect ratio and negligible sweepback angles (see Table 2.03). Although for the low aspect ratio delta wing planforms better agreement between analytical and experimental solutions are obtained with the control point locations aft of the  $3/4$  chord of the panels, the best control point location which provides accurate results for any wing planform is considered to be at the 77 percent of the elemental chords. (7, 19)

#### 2.9.2 Wings of Moderate Aspect Ratio and Negligible Sweepback

Three different basic wing planforms of aspect ratio of six having no twist and zero sweepback at the  $1/4$  chord are considered. Solutions for the integrated wing airload coefficients using the present vortex lattice program and the lifting line theory<sup>(18)</sup> are compared in Table 2.03. The lattice network arrangements and corresponding section lift distributions for the vortex lattice solutions are shown in Figure 2.08. The comparison of the calculated span loadings for the rectangular and the straight tapered wings against lifting line semi-empirical predictions<sup>(20, 21)</sup> is presented in Figure 2.09. A qualitative evaluation of results shows that the program predictions are in good agreement with the lifting line exact theory and the lifting line semi-empirical predictions.

#### 2.9.3 Wings of Low Aspect Ratio and Large Sweepback

Wing planforms of low aspect ratio having no twist and large leading edge sweepback angles for which comprehensive wind tunnel test data are available are considered.<sup>(23, 24)</sup> The range of wing planforms includes delta, clipped delta, and straight tapered configurations of aspect ratios ranging from two to four and leading edge sweepback angles as large as  $60^\circ$  (see Table 2.04). The airfoil sections are relatively thin ( $\sim 3$  percent) with sharp or rounded nose sections. Under these conditions locally separated flow at the wing leading edge with the accompanying vortex lift and loss of leading edge suction force occurs. Analytical solutions for the wing plan-

forms were generated by the program assuming no separated flow and fully separated flow at the leading edges. Analytical predictions for the integrated airload coefficients are compared with the experimental test results in Table 2.04. Comparisons for a range in angle of attack from  $0^\circ$  to  $25^\circ$  are shown for four representative wing planforms in Figures 2.10 through 2.12. Comparisons of the lift distribution on the lifting surface for a delta wing planform are presented in Figure 2.13. The analytical solutions in the table and the figures were calculated assuming a control point location of 77 percent of chord for the elemental panels. An evaluation of the overall results leads to the following conclusions.

- 1) The analytical solutions for the integrated wing lift coefficients are found in excellent agreement with the wind tunnel test results (Figure 2.10). In general, the analytical solutions with and without leading edge suction bound the experimental results.
- 2) Analytical solutions for the wing drag coefficients when compared with the experimental results, although in less agreement, showed the same trends as for the lift (Figure 2.11).
- 3) The analytical solutions for the integrated wing pitching moment coefficients about the  $1/4$  of the mean geometric chord are not found to be in good agreement with the wind tunnel test results (Figure 2.12). Differences of the order of 25 percent are encountered for the delta wing planform of aspect ratio of two and somewhat smaller for the other wings. The reasons for the discrepancies encountered for the pitching moment probably arise from two sources. First, the test data for the wings were deduced from tests conducted for wings with a slender fuselage. To obtain the characteristics of wing alone, data for the fuselage alone was subtracted from the wing-fuselage data and, as a result, the wing-fuselage interference effect was neglected. Second, for the delta wing configurations the calculated lift in the tip regions is extremely large while in the real test environment stalling in these regions would surely occur. This would result in a redistribution of the vorticity on the wing upper and lower surfaces which cannot be represented accurately by the vortex lattice theory (see Figure 2.13). In addition, it should be noted that the pitching moment error for the  $\bar{C}/4$  location is somewhat

misleading in assessing the accuracy of the vortex lattice method since at this location the magnitude of the pitching moment is of zero order, i.e., more than an order of magnitude smaller than the wing lift coefficient. The error in the pitching moment predictions for the  $\bar{C}/4$  location (Figure 2.12) represents a difference of about 2.5 % of  $\bar{C}$  on the location of the center of pressure at moderate angles of attack ( $\alpha < 5^\circ$ ) that is equivalent to about 1% of the maximum chord length of the wing. Another point worth noting is that the vortex lift was found to be many times smaller than the wing lift calculated by the vortex lattice method. Therefore, the approximate treatment of the vortex lift by the suction analogy is considered satisfactory in determining the net airload sum for the wing.

#### 2.9.4 Ground Effects

Analytical solutions that include the ground effects are obtainable by the method of images by assuming the ground plane to be perfectly flat and of infinite extent. Under these conditions, the boundary requirements for the flow at the ground plane are exactly satisfied by defining a wing image located directly below the wing at a distance equal to twice the altitude from the ground plane. For altitudes equal or greater than one chord length, the lifting line and the lifting surface analytical techniques provide comparable and accurate solutions to the problem. When the altitude from the ground plane is diminished below the one-chord length, the chordwise distribution of circulation is very strongly affected by the presence of the ground plane. In this range of altitudes, only the lifting surface methods such as the vortex lattice analysis technique can be expected to provide accurate solutions.

The accuracy of the present program for predicting ground effects may be demonstrated by comparing analytical solutions against lifting line predictions<sup>(25, 26)</sup> and experimental test results.<sup>(26)</sup> In accomplishing these objectives, ground effects were calculated for three different wing planforms for which comprehensive wind tunnel test and/or flight data are available. A comparison of results is shown in Figure 2.14. In examining the figure, the following observations are made:

- 1) For the rectangular wing planform of aspect ratio of six shown in the figure (Figure 2.14[A]), the program predictions of the ground effects are found to be in perfect agreement with the flight test

data<sup>(26)</sup> for the range of altitudes tested. As expected, the lifting line theory<sup>(25, 26)</sup> is inaccurate very near the ground plane ( $H/\bar{C} \leq 1$ ).

- 2) For the straight tapered wing of aspect ratio of ten (Figure 2.14[B]), the program predictions are found in very good agreement with the experimental data obtained in the wind tunnel.<sup>(27)</sup> Again, at distances very near the ground plane, the lifting line theory<sup>(26)</sup> proves to be inaccurate. An illustration of the corresponding variation of the span lift distribution due to the ground effects is also shown in the figure.
- 3) For a delta wing of aspect ratio of 2.309 (Figure 2.14[C]), the present program predictions are compared with semi-empirical results reported by Fox.<sup>(28)</sup> The analytical predictions of the ground effects by the program are found not to be in very good agreement with these results. However, the accuracy of this data is suspected since the wing lift coefficient out-of-ground is found to be about 20 percent larger than reported by other investigators for comparable delta wing planforms operating at the same angle of attack<sup>(23, 24)</sup> (see Figure 2.10, Configuration C1).

#### 2.9.5 Wings of Unusual Planforms

Analytical predictions of the aerodynamic characteristics for wings having large sweepback angles and unusual planforms obtained by the present program and the lifting line theory<sup>(29, 30)</sup> are compared in Figures 2.15 and 2.16. In the first figure, the span loading distribution predictions for three different wing planforms of aspect ratio of six having continuous and broken sweepback of  $45^\circ$  at the  $1/4$  chord are presented. In all three cases good agreement is found between the vortex lattice and the lifting line predictions. Although the larger discrepancies are found at the root region, the small differences encountered in the span loading predictions are probably due to the greater accuracy of the vortex lattice method for representing the real problem. Predictions for the lift slope and the location of the center of pressure on the wing surface also shown in the figure are found to be in good agreement. In the second figure (Figure 2.16), predictions of the effect of varying the sweepback angle on the wing lift slope for straight tapered wings of aspect ratio of six are compared. Again, a comparison between the vortex lattice and lifting line solutions are found to be in good agreement.



#### 2.9.6 Wings With Severe Surface Discontinuities

The accuracy of the present vortex lattice program for analyzing wing planforms having severe surface discontinuities is considered in this section. Such discontinuities arise from two sources: (1) sharp discontinuities in the wing surface such as: abrupt changes in the wing dihedral, the presence of wing-tip end plates, boundary layer flow fences, etc., and (2) trailing edge surface discontinuities arising from large deflections of control devices such as flaps or ailerons. The solutions for one example of each of these types of discontinuities is considered and compared against experimental results or other theoretical solutions.

##### 1) Wing of Aspect Ratio of Four with End Plates

The exact analytical treatment of arbitrary wing planforms with end plates at the tip can only be performed using the exact geometry (no linearization) in prescribing the boundary conditions. The problem presents the most severe test for the analytical method because of the very large velocities induced in the spanwise directions by the end plate bound vortex filaments. Analytical predictions performed by the present program are compared with experimental results<sup>(31)</sup> for a rectangular wing of aspect ratio of four with large end plates in Figure 2.17. The analytical results showed a stronger effect of the end plates on the wing lift (about 30 percent larger) than obtained in the wind tunnel experiments. This discrepancy is probably due to the presence of separated flow in the corners of the wing-end plate junctures which would account for the loss of lift.

##### 2) Straight Tapered Wing of Aspect Ratio of Six with Flapped Surfaces

A straight tapered wing of aspect ratio of six having simple trailing edge flapped surface of 25 percent of chord is considered. The flapped surfaces are assumed to be constituted by the wing flaps and the ailerons which extend from the root to the 62.5 percent and from the 62.5 percent wing station to the tip respectively (see Figure 2.18). Analytical solutions were obtained by the program for symmetric and unsymmetric span loadings. Symmetric span loadings were calculated for the wing operating with the flaps extended  $30^\circ$  and the ailerons neutral, and unsymmetric span loadings, by assuming unequal aileron

deflections of  $10^\circ$  down and  $15^\circ$  up for the left and right ailerons respectively. The handling of the flap-aileron junction surface discontinuity was treated using the smoothing procedure described in Section 2.7 using  $\delta/(b/2)$  value of 0.20. A summary of the principal results obtained were plotted using the program standard plotting option and are presented in Figure 2.18. A comparison between the results obtained and the lifting line and thin airfoil theory analytical predictions<sup>(9)</sup> are presented in Table 2.05. As shown in the table, the vortex lattice method predictions for the airload increments due to the flapped surface deflections are found to be smaller than by the other method. The discrepancies in the results probably are due to the fact that in the present vortex lattice method the exact geometry of the wing section camber distributions are considered while for the other method (thin airfoil theory) approximate geometric boundary conditions (which are valid only at very small flapped surface deflections) are used. The fact that the vortex lattice predictions for the wing airloads increments are smaller is a most revealing result. Note that solutions obtained based on thin airfoil theory usually overestimate the effect of the flapped surfaces by about 20 percent.

#### 2.9.7 Multiple-Surface Configurations

The accuracy of the present vortex-lattice analysis program in obtaining solutions for vehicle configurations that are represented by two or more lifting surfaces is to be evaluated in this section. Typical example configurations under this category are: wing + horizontal tail (2 surfaces), wing + canard control surface (2 surfaces), thick wing (2 surfaces), wing + horizontal tail + vertical tail + fuselage (4 surfaces), lifting body (2 or more surfaces), etc. The significant characteristic of the multiple-surface problem is the mutual influence or interference effect that each surface exerts on all the other surfaces. Such problems can only be properly analyzed by the vortex-lattice and surface-integral<sup>(7)</sup> methods. In determining the accuracy of the present analysis, analytical predictions were performed for three representative vehicle configurations for which wind-tunnel or flight data of sufficient quantity and accuracy is available. The results obtained, a comparison between analytical predictions versus experimental data, are presented in Figures 2.19 through 2.21. The vehicle con-

figurations and type of experimental data sources studied were as follows:

1) out-of-ground wind tunnel tests conducted for a wing + canard surface + slender fuselage model in Reference 32, 2) flight test data in and out of ground conducted for the Douglas F5D-1 prototype airplane with a modified ogee wing,<sup>(33)</sup> and 3) flight test data in- and out-of-ground for the North American XB-70 Airplane.<sup>(33)</sup> In examining the comparisons presented in the figures, it must be concluded that the present vortex-lattice analysis method is capable of predicting the aerodynamic loads within a few percent (1 percent to 5 percent) of the experimental results. The details of the technical evaluation that led to this conclusion are discussed below.

#### 1) Out-of-Ground Predictions

Analytical predictions for lift, induced drag, and pitching moment for the wing-canard-fuselage model are compared against wind tunnel test results in Figure 2.19. The predictions for the lift coefficient are found to be in remarkable agreement with the test data, i.e., within one percent. This result was obtained notwithstanding of the very strong mutual interference effect that the canard surface exerts on the wing that is predicted by the analysis (see Table 2.06). The induced drag predictions are also found to be in very good agreement with the test data, especially if it is taken into account the fact that the magnitude of the induced drag force is much smaller (by a Factor of  $\sim 10$ ) in comparison with the lift force. Similarly, comparisons for the pitching moment are given about the C.G. and the trailing-edge of the wing root chord. Although a very large discrepancy is found between the predicted and the test data for the pitching moment when expressed about the C.G., the scale of the pitching moment here is very small and misleading. By expressing the pitching moment about the aftermost location of the wing surface, the trailing-edge of the wing root chord, a more meaningful evaluation of results is possible. This fact can be corroborated by calculating the discrepancy of the location of the center of pressure that reveals the cause for the discrepancy in the pitching moment. Accordingly, the predicted location of the center of pressure when compared against the test data is off by about ten percent of the wing  $\bar{C}$ , or, about three percent of the

model length. Since varying the vortex-lattice arrangement or the number of control points showed no significant change on the predictions, it is concluded that the analytical predictions represent an exact solution. Then, the small discrepancy encountered in the pitching moment (Figure 2.19d) or center of pressure location can only be attributed to wind tunnel test measurement errors or to the fact that the exact geometry of the wind tunnel model was only approximately represented by the vortex-lattice arrangement used in carrying out the calculations of analytical predictions.

## 2) In-Ground-Predictions

Analytical predictions for the lift of full-size vehicles in flight in the presence or absence of a very near ground plane are compared against flight test data<sup>(34)</sup> in Figures 2.20 and 2.21. In general, relative good agreement is found between the analytical predictions and the flight test data. Although better agreement is found for the out-of-ground comparisons, this finding is not surprising when considering the great difficulties encountered in obtaining accurate data very near the ground plane. Corrections on the lift due to varying control surface deflections, jet thrust, etc., that include the ground effect are difficult to assess and are generally ignored.

TABLE 2.01 - VORTEX-LATTICE GEOMETRY EFFECT ON THE CALCULATED WING AIRLOADS (PROGRAM HAO10B)  
 FOR A DELTA WING OF ASPECT RATIO = 2, OPERATING AT  $\alpha = 10^\circ$  AND  $M = 0.25$

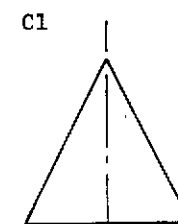
	VORTEX MATRIX GEOMETRY					WITH L. E. SUCTION (BLUNT L. E.)			NO L. E. SUCTION (SHARP L. E.)			EXECUTION TIME
	NO. SPAN ELEMENTS	SPAN SPACING†	NO. CHORD ELEMENTS	CHORD SPACING†	TOTAL NO. ELEMENTS	$C_L$	$C_{D_i}$	$C_{M(\bar{C}/4)}$	$C_L$	$C_{D_i}$	$C_{M(\bar{C}/4)}$	SECONDS‡
1	14	0	5	0	70	0.3708	0.0476	-0.0825	0.4071	0.0722	-0.0882	39
2	14	1	5	0	70	0.3765	0.0472	-0.0845	0.4149	0.0735	-0.0905	38
3	14	0	5	1	70	0.3717	0.0488	-0.0801	0.4074	0.0729	-0.0860	39
4	14	1	5	1	70	0.3770	0.0478	-0.0830	0.4152	0.0739	-0.0890	39
5	20	0	5	0	100	0.3739	0.0486	-0.0827	0.4098	0.0729	-0.0885	73
6	20	1	5	0	100	0.3765	0.0483	-0.0843	0.4141	0.0734	-0.0904	73
7	20	1	5	1	100	0.3772	0.0495	-0.0818	0.4137	0.0738	-0.0881	74
8	14	1	9	0	136	0.3752	0.0477	-0.0837	0.4127	0.0733	-0.0895	106

†LEGEND

1 = COSINE SPACING

0 = CONSTANT SPACING

‡EXECUTION TIME INCLUDES  
 LINEAR ARRAY SOLUTIONS



AR = 2

TR = 0

$\Lambda_{\bar{C}/4} = 56^\circ$

TABLE 2.02 - VORTEX-LATTICE CONTROL POINT LOCATION EFFECT ON THE CALCULATED WING AIRLOADS (PROGRAM HA010B)  
 FOR A DELTA WING OF ASPECT RATIO = 2, OPERATING AT  $\alpha = 10^\circ$  AND  $M = 0.25$

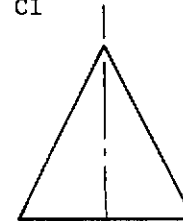
LOCATION OF CONTROL POINT % OF ELEMENT CHORD		75%	80%	83%	77%
VORTEX MATRIX GEOMETRY	NO. SPAN ELEMENTS	14	14	14	14
	SPAN SPACING†	1	1	1	0
	NO. CHORD ELEMENTS	5	5	5	5
	CHORD SPACING†	0	0	0	0
WITH L. E. SUCTION (BLUNT L. E.)	$C_L$	0.3673	0.3908	0.4044	0.3708
	$C_{D_i}$	0.0462	0.0527	0.0568	0.0476
	$C_{M(\bar{C}/4)}$	-0.0846	-0.0838	-0.0823	-0.0825
NO L. E. SUCTION (SHARP L. E.)	$C_L$	0.4051	0.4359	0.4602	0.4071
	$C_{D_i}$	0.0714	0.0769	0.0812	0.0722
	$C_{M(\bar{C}/4)}$	-0.0903	-0.0892	-0.0885	-0.0882

†LEGEND

1 = COSINE SPACING

0 = CONSTANT SPACING

C1



AR = 2

TR = 0

$\Lambda_{\bar{C}/4} = 56^\circ$

TABLE 2.03 - WING AIRLOAD PREDICTION COMPARISONS FOR WING PLANFORMS OF MODERATE ASPECT RATIO

ANALYSIS	GEOMETRY				AERO COEFFICIENTS AT $\alpha = 10^\circ$ , $M = 0$				
	PLANFORM	ASPECT RATIO	TAPER RATIO	SWEEP $\Lambda(\bar{C}/4)$	$C_L$	$C_{M(\bar{C}/4)}$	$C_{D_i}$	WING LIFT SLOPE $C_{L_i}/\text{DEG}$	WING A. C. $\% \bar{C}$
TRW VORTEX-LATTICE METHOD (PROGRAM HA010B) CONTROL POINT AT 75%	RECTANGULAR	6	1	0	0.7567	0.0004	0.0355	0.07567	24.99
	TAPERED	6	1/3	0	0.7795	0.0031	0.0367	0.07795	24.59
	ELLIPTICAL	6.04	0	0	0.7865	-0.0211	0.0377	0.07865	27.71
NACA REPORT NO. 631 <sup>(18)</sup> SECTION LIFT SLOPE $a_o = 2\pi \times 57.3$	RECTANGULAR	6	1	0	0.7870	0	0.0345	0.07870	25.00
	TAPERED	6	1/3	0	0.8195	0	0.0363	0.08195	25.00
	ELLIPTICAL	6	0	0	0.8220	0	0.0358	0.08220	25.00
TRW VORTEX-LATTICE METHOD (PROGRAM HA010B) CONTROL POINT AT 77%	RECTANGULAR	6	1	0	0.7779	0.0068	0.0373	0.07779	24.12
	TAPERED	6	1/3	0	0.8011	0.0097	0.0387	0.08011	23.78
	ELLIPTICAL	6.04	0	0	0.8081	-0.0149	0.0398	0.08081	26.84
NACA REPORT NO. 631 <sup>(18)</sup> SECTION LIFT SLOPE $a_o = 0.099$ (NACA0012 AIRFOIL)	RECTANGULAR	6	1	0	0.7286	0.0044	0.0295	0.07286	24.40
	TAPERED	6	1/3	0	0.7564	0.0045	0.0307	0.07564	24.40
	ELLIPTICAL	6	0	0	0.7610	0.0046	0.0307	0.07610	24.40

TABLE 2.04 - WING AIRLOAD PREDICTION COMPARISONS FOR WING PLANFORMS OF MODERATE ASPECT RATIO AT  $\alpha = 5^\circ$ 

CONFIGURATION					TEST CONDITIONS		ANALYSIS <sup>†</sup> (PROGRAM HA010B)		EXPERIMENT	WING AIRLOAD COEFFICIENTS			C. P. LOCATION
PLANFORM	ASPECT RATIO	TAPER RATIO	SWEEP ANGLE $\Lambda(C/4)$	AIRFOIL SECTION	MACH NUMBER	REYNOLDS NUMBER	WITH L. E. SUCTION (BLUNT L. E.)	NO L. E. SUCTION (SHARP L. E.)	NACA RM A53A30	$C_L$	$C_{D_i}$	$C_{M(\bar{C}/4)}$	$\bar{x}$
DELTA	2	0	56.0°	NACA 0001-63	0.25	$16.6 \times 10^6$	X			0.1849	0.0193	-0.0423	47.87
								X		0.1941	0.0248	-0.0435	47.41
									X	0.1830	0.0165	-0.0333	43.19
DELTA	3	0	45.0°	NACA 0003-63	0.25	$10.6 \times 10^6$	X			0.2433	0.0210	-0.0412	41.91
								X		0.2547	0.0304	-0.0422	41.56
									X	0.2390	0.0200	-0.0332	38.89
DELTA	4	0	37.0°	3% THICK ROUNDED NOSE SECTION	0.25	$9.1 \times 10^6$	X			0.2893	0.0215	-0.0384	38.27
								X		0.3029	0.0348	-0.0391	37.90
									X	0.2830	0.0255	-0.0299	35.56
TAPERED	3.08	0.39	11.5°	3% THICK BICONVEX SECTION	0.25	$8.3 \times 10^6$	X			0.3104	0.0216	-0.0007	25.22
								X		0.3214	0.0362	+0.0023	24.28
									X	0.2860	0.0278	+0.0121	20.76
TAPERED	3	0.40	40.6°	3% THICK BICONVEX SECTION	0.25	$8.4 \times 10^6$	X			0.2615	0.0213	-0.0203	32.76
								X		0.2722	0.0319	-0.0186	31.83
									X	0.2710	0.0275	-0.0175	31.45
RECTANGULAR	2	1.0	0°	3% THICK BICONVEX SECTION	0.61	$4.4 \times 10^6$	X			0.3000	0.0254	0.0000	25.00
								X		0.3109	0.0352	+0.0031	24.00
									X	0.2650	0.0271	+0.0150	19.339
CLIPPED DELTA	2	0.33	37.0°	3/8 THICK BICONVEX SECTION	0.61	$4.8 \times 10^6$	X			0.2800	0.0295	-0.0226	33.07
								X		0.2918	0.0336	-0.0204	31.99
									X	0.2600	0.0310	-0.0161	31.92

<sup>†</sup>COLOCATION POINT LOCATION AT 77% OF ELEMENT CHORD  
AND  $c_{d_o} = 0.007$  WERE USED IN THE ANALYSIS.



TABLE 2.05 - COMPARISON OF CALCULATED AIRLOAD COEFFICIENT INCREMENTS DUE TO FLAP DEFLECTION FOR A 25% OF CHORD FLAPPED SURFACE

	SECTION COEFFICIENT INCREMENTS PER DEGREE OF FLAP DEFLECTION AT $Y/(b/2) = 0.40$			
	$\Delta c_l / \delta_f^\circ$	$\Delta c_m(C/4) / \delta_f^\circ$	$\Delta c_n / \delta_f^\circ$	$\Delta c_h / \delta_f^\circ$
VORTEX LATTICE METHOD (PROGRAM HA010B)	0.040	-0.01166	0.0566	-0.0140
LIFTING LINE THEORY (WAKE II PROGRAM <sup>(9)</sup> )	0.0672	-0.01138	0.0487	-0.0164

Note: The results presented were calculated for a 25% chord flap deflected  $30^\circ$  with the wing operating at zero angle of attack (See Figure 2.18).

TABLE 2.06 - MULTIPLE-LIFTING-SURFACES INTERFERENCE EFFECT PREDICTIONS (HA0010B) FOR A SELECTED WING-CANARD-FUSELAGE CONFIGURATION (SEE FIGURE 2.19)

COMMENT	WING LIFT COEFFICIENT $C_{L_\pi}$ BASED ON $S_\pi$ AND $\alpha = 12.5^\circ$				
	WING $S_\pi = 694.18$	CANARD $S_\pi = 113.04$	CENTER FUS $S_\pi = 17.53$	FUS NOSE $S_\pi = 26.44$	SUM AT C.G. $S_\pi = 694.18$
WING ALONE	0.7091				0.7091
CANARD ALONE		0.5214			0.0849
WING + CANARD	0.6694	0.4129			0.7366
WING + CANARD + FUS	0.6539	0.3982	0.1420	0.1420	0.7318

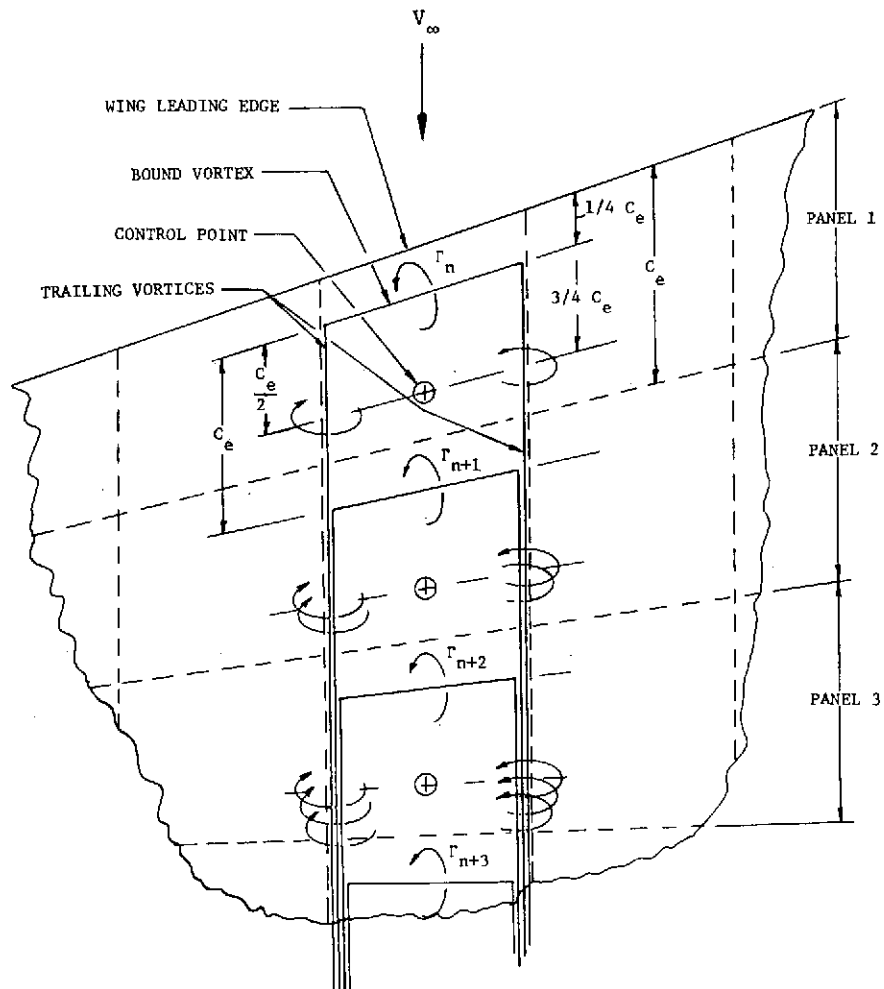


FIGURE 2.01 - SKETCH OF A CHORDWISE ROW OF VORTICES

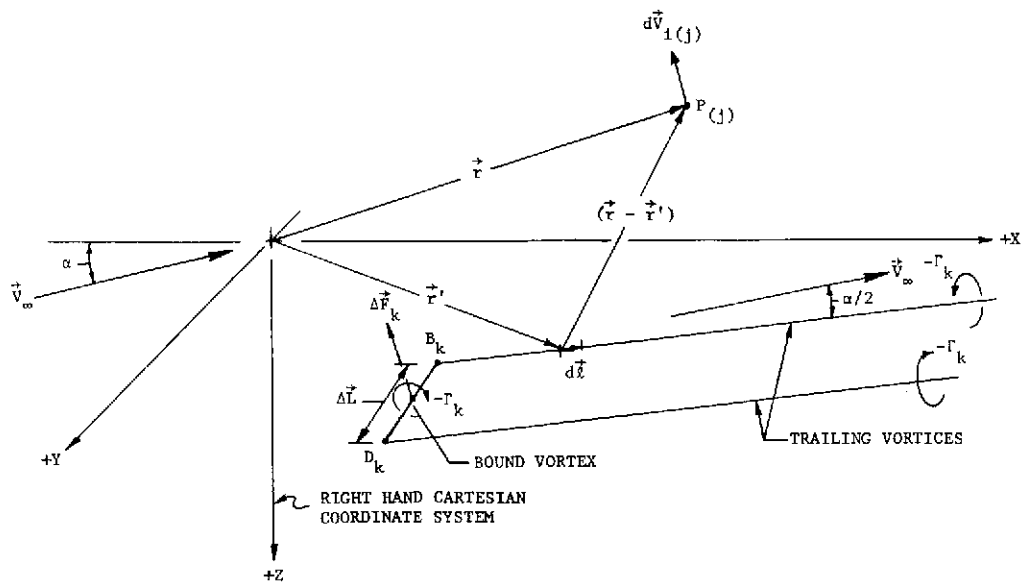


FIGURE 2.02 - GEOMETRY CONVENTION FOR A SKEW-SHAPED HORSESHOE VORTEX FILAMENT IN THE GENERAL COORDINATE SYSTEM

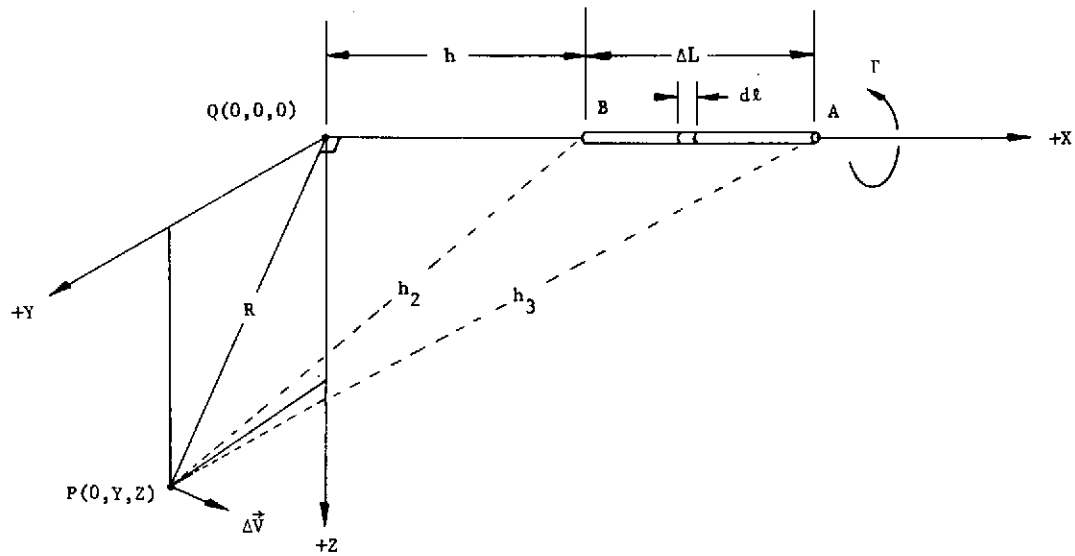


FIGURE 2.03 - VELOCITY INDUCED BY AN ELEMENTAL VORTEX FILAMENT OF LENGTH  $\Delta L$  DEFINED IN A LOCALIZED COORDINATE SYSTEM

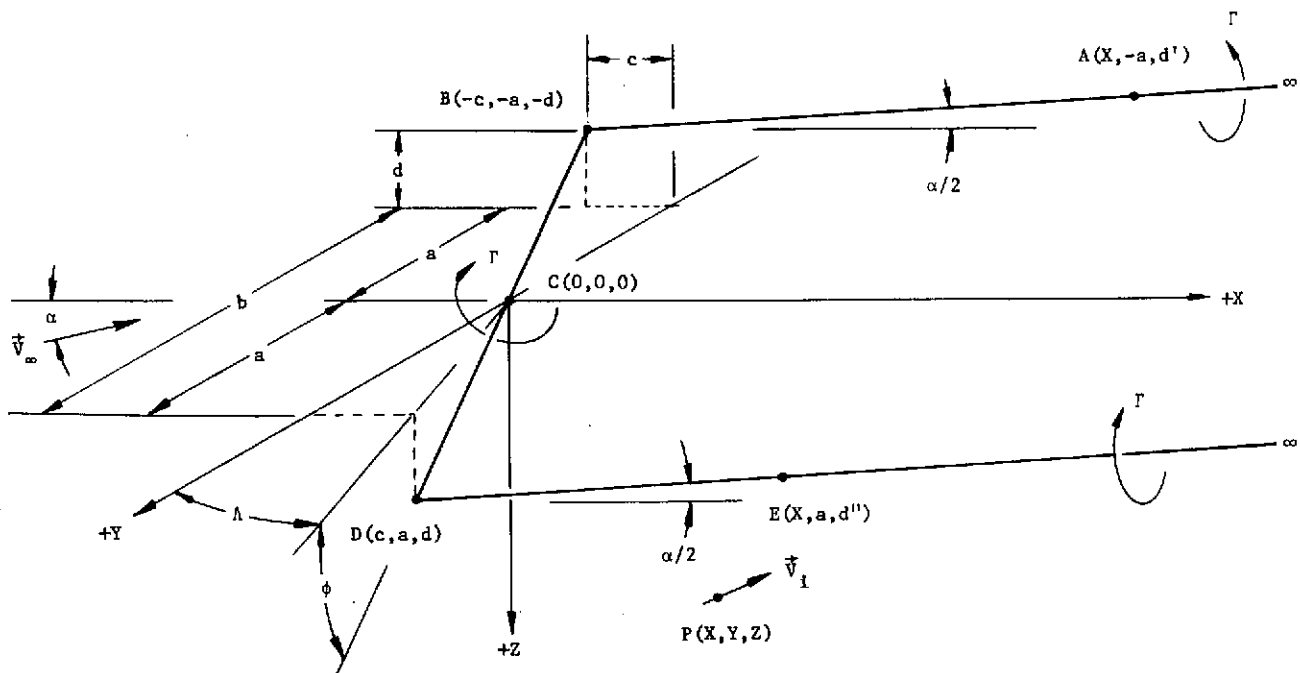
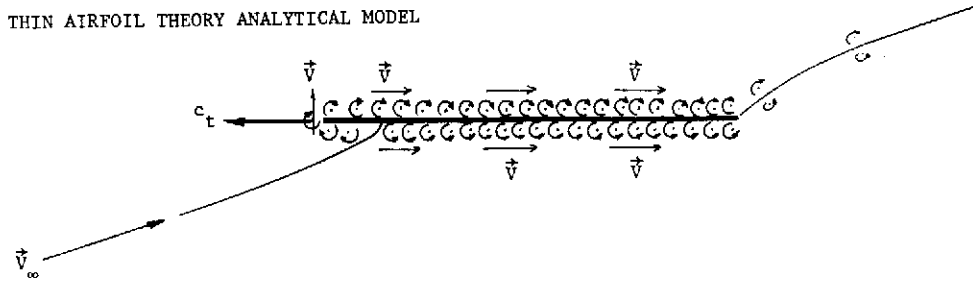


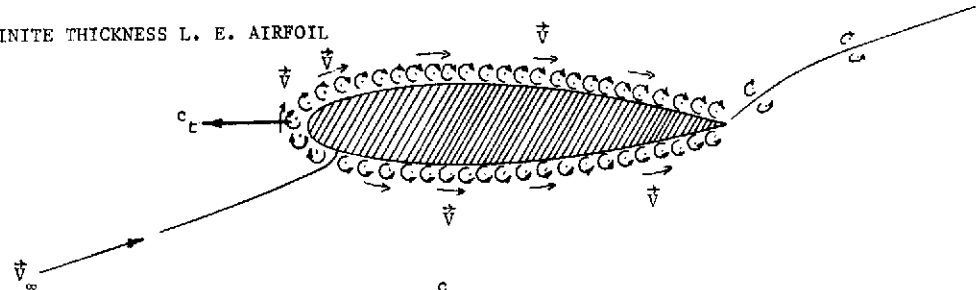
FIGURE 2.04 - GEOMETRY CONVENTION FOR A SKEW-SHAPED HORSESHOE VORTEX FILAMENT DEFINED IN THE LOCAL COORDINATE SYSTEM

WITH L. E. SUCTION  
(BLUNT L. E. WING)

A) THIN AIRFOIL THEORY ANALYTICAL MODEL



B) FINITE THICKNESS L. E. AIRFOIL



NO L. E. SUCTION  
(SHARP L. E. WING)

C) SHARP L. E. AIRFOIL

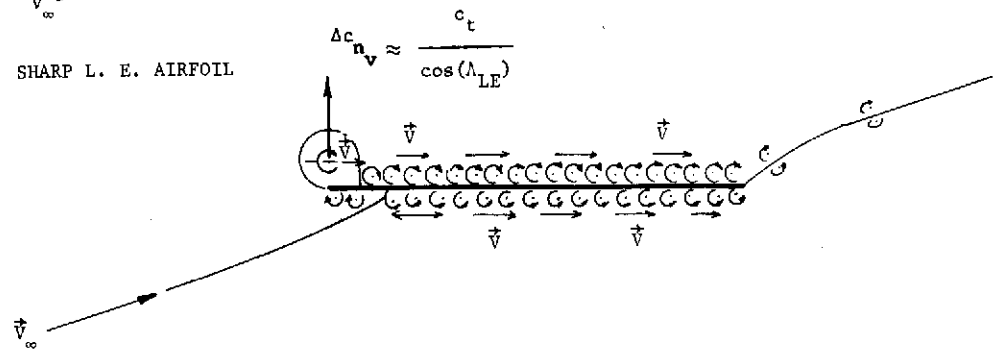


FIGURE 2.05 - ILLUSTRATION OF THE ORIGINS OF THE VORTEX LIFT

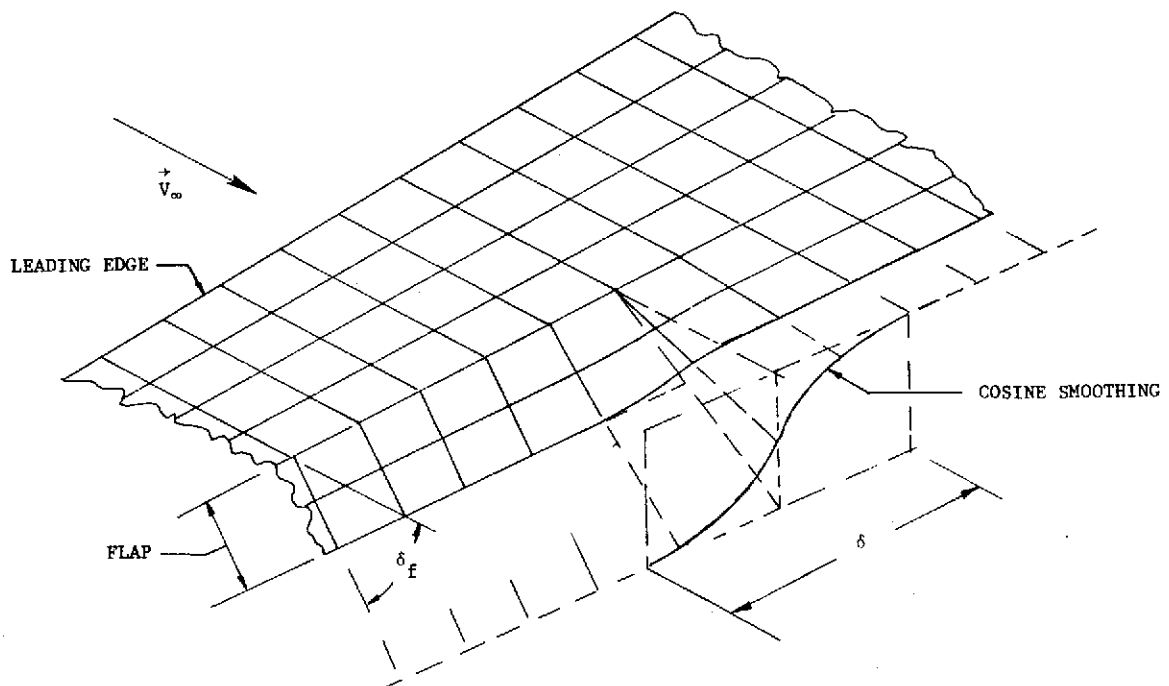


FIGURE 2.06 - COSINE SMOOTHING OF SHARP SURFACE-DISCONTINUITIES

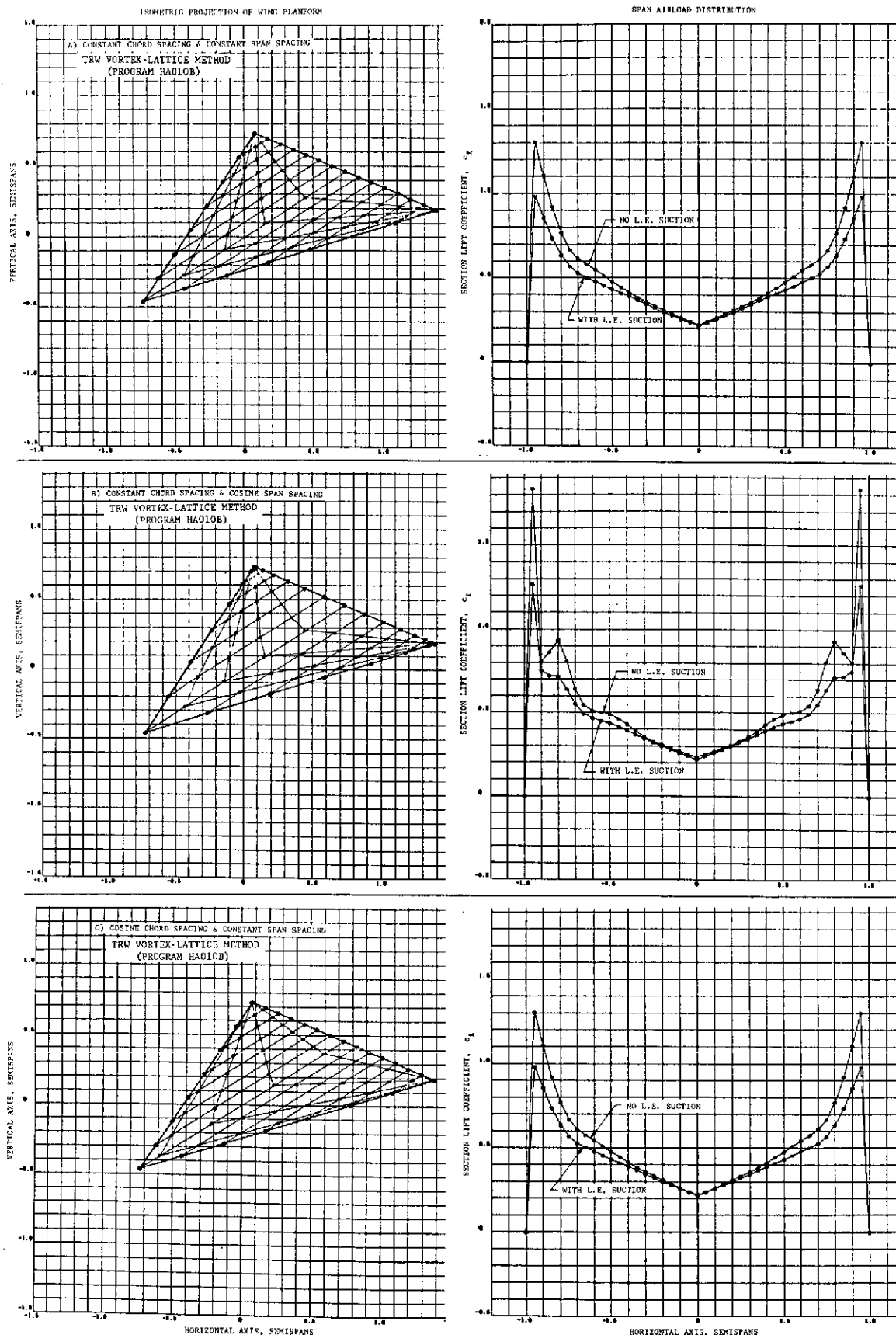


FIGURE 2.07 - VARIATION OF VORTEX-LATTICE ARRANGEMENT EFFECT ON THE SPAN SECTION LIFT DISTRIBUTION FOR A DELTA WING OF ASPECT RATIO = 2 AT AN ANGLE OF ATTACK  $\alpha = 10^\circ$

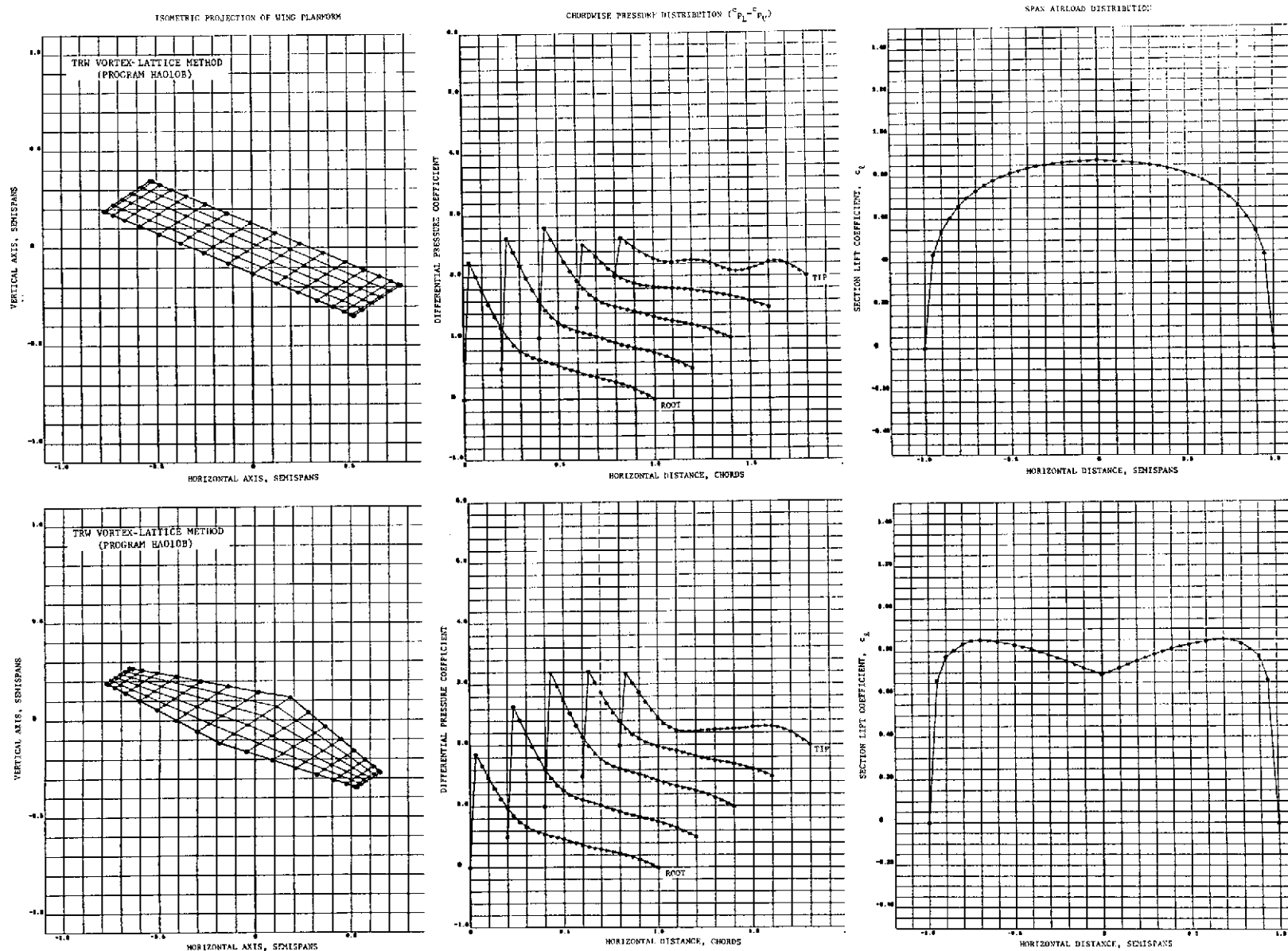


FIGURE 2.08 - LIFT DISTRIBUTION PREDICTIONS (PROGRAM HA010B) FOR FOUR BASIC WING PLANFORMS  
AT AN ANGLE OF ATTACK  $\alpha = 10^\circ$

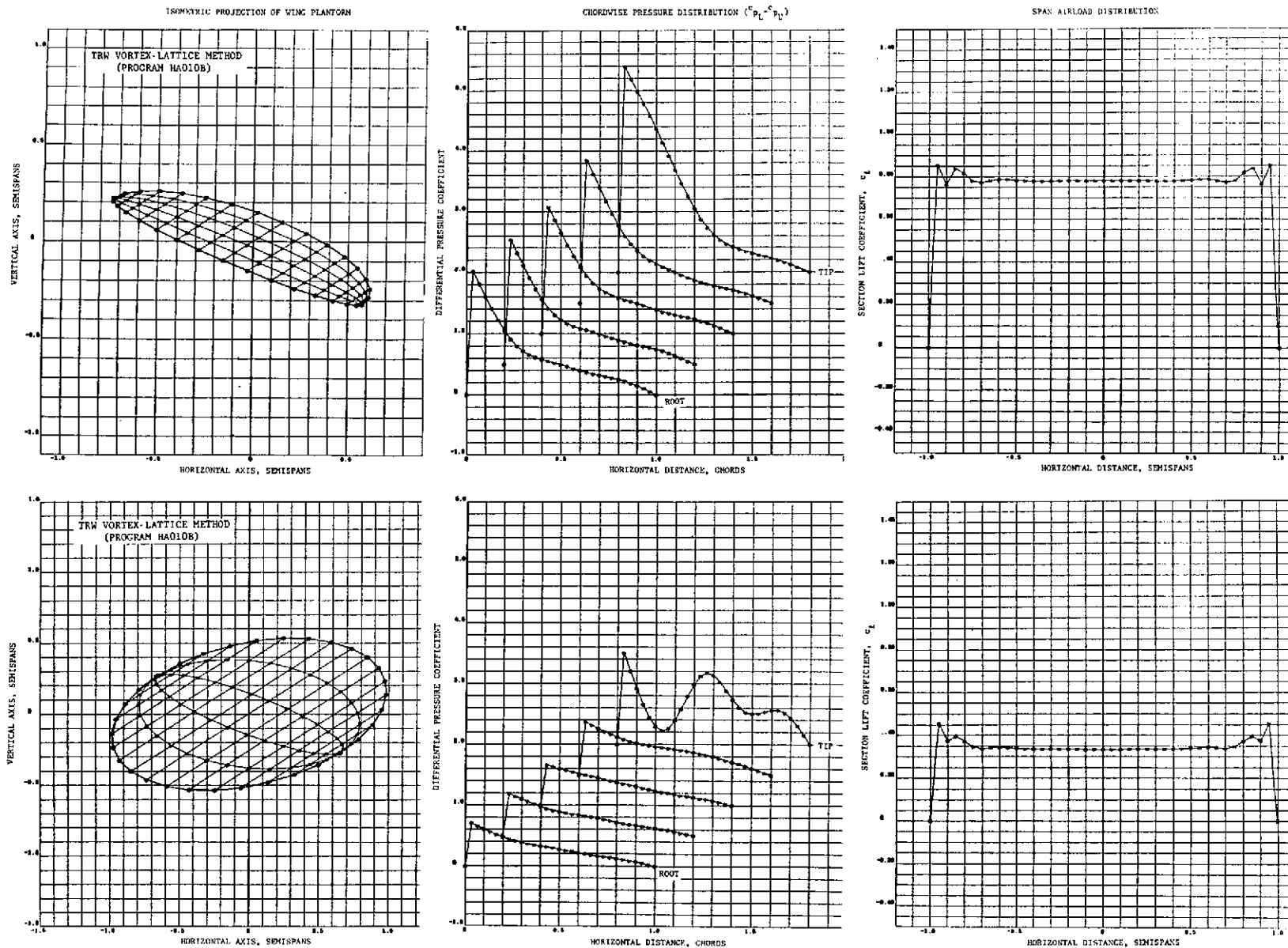


FIGURE 2.08 - LIFT DISTRIBUTION PREDICTIONS (PROGRAM HA010B) FOR FOUR BASIC WING PLANFORMS  
AT AN ANGLE OF ATTACK  $\alpha = 10^\circ$ , CONTINUED

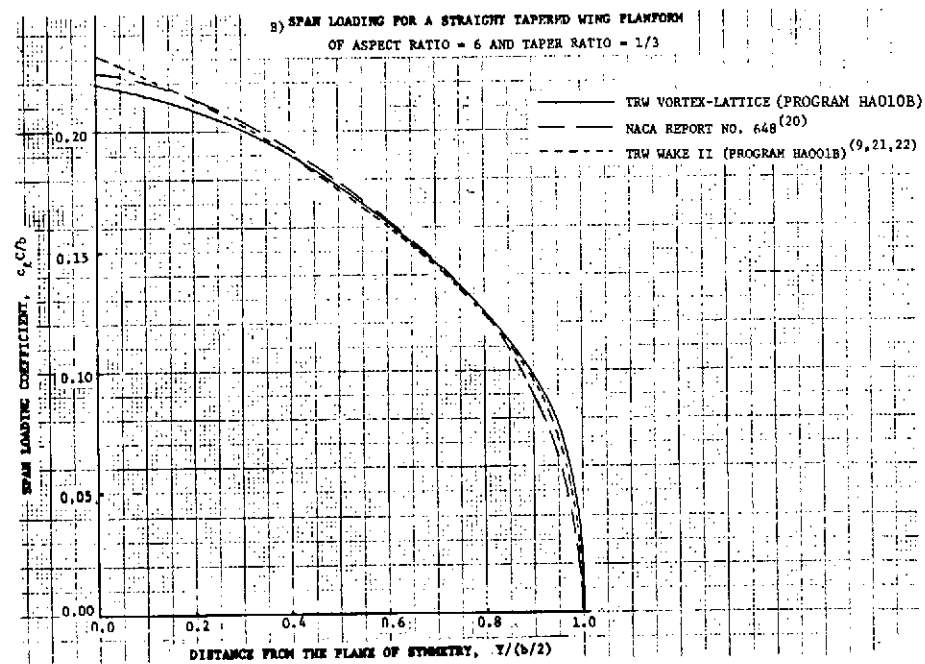
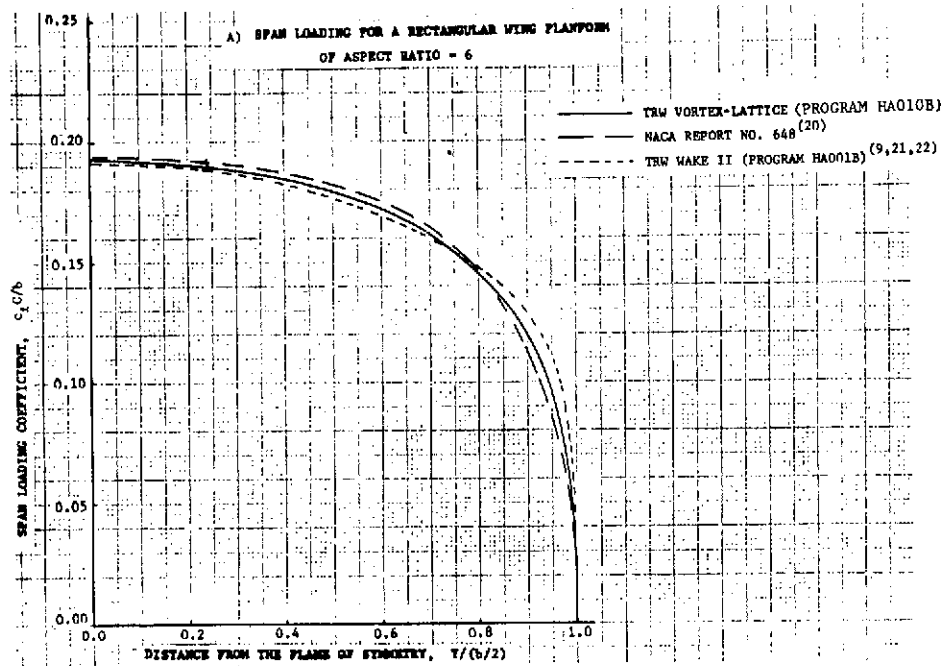


FIGURE 2.09 - SPAN LOADING PREDICTION COMPARISONS FOR TWO BASIC WING PLANFORMS  
OF ASPECT RATIO = 2



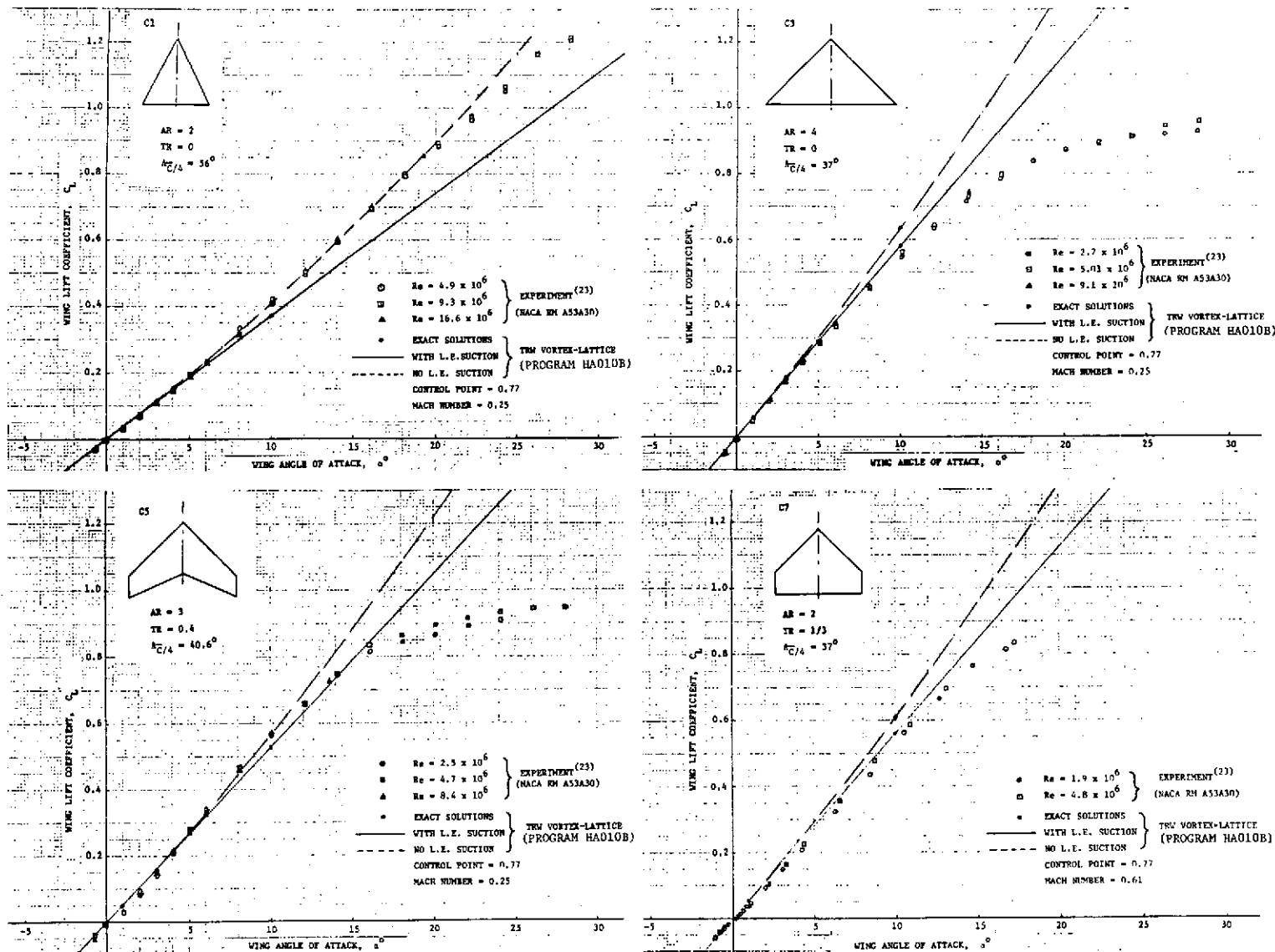


FIGURE 10 - WING LIFT PREDICTION COMPARISONS FOR SELECTED LOW ASPECT RATIO WING PLANFORMS

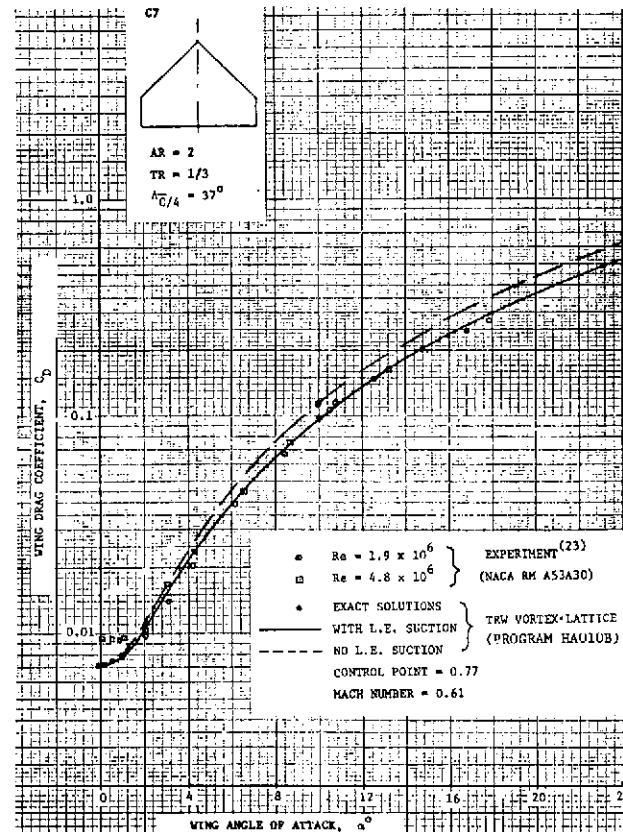
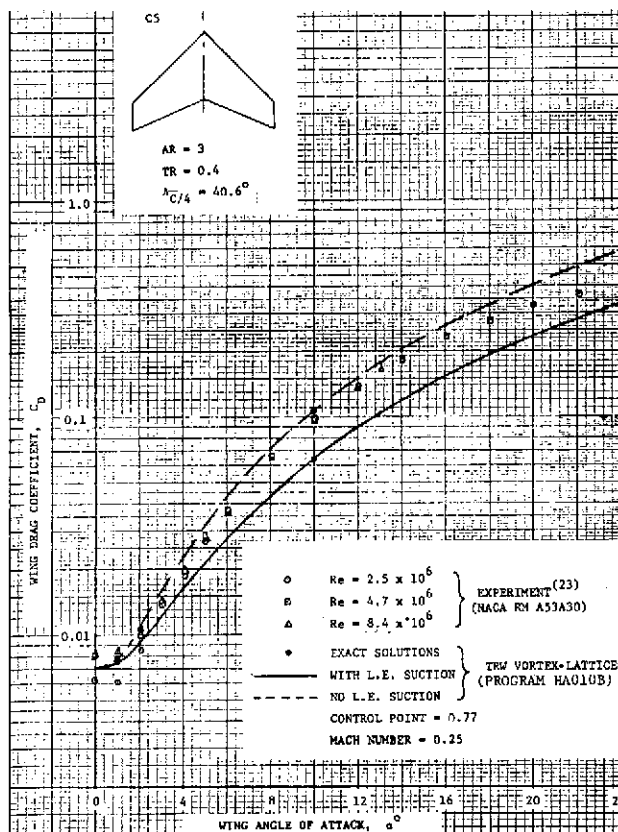
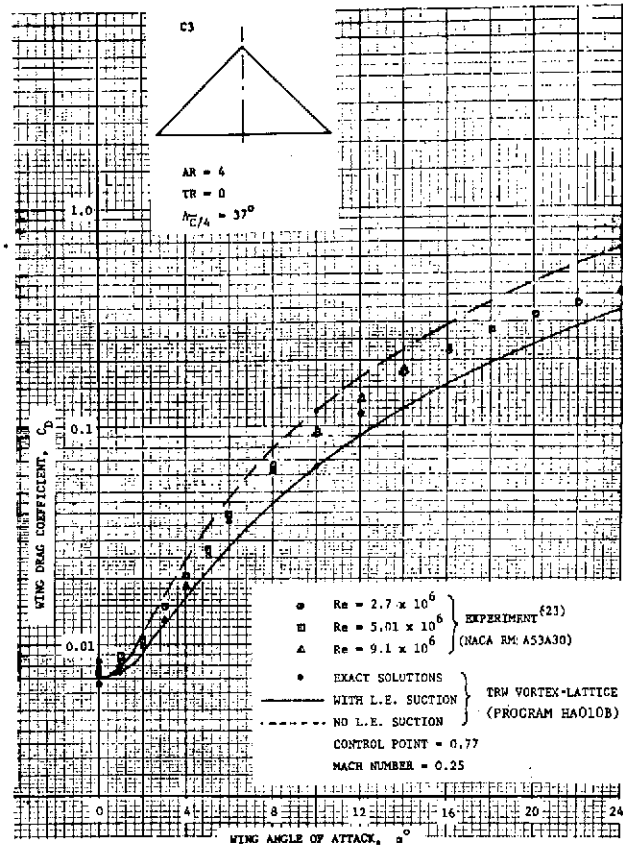
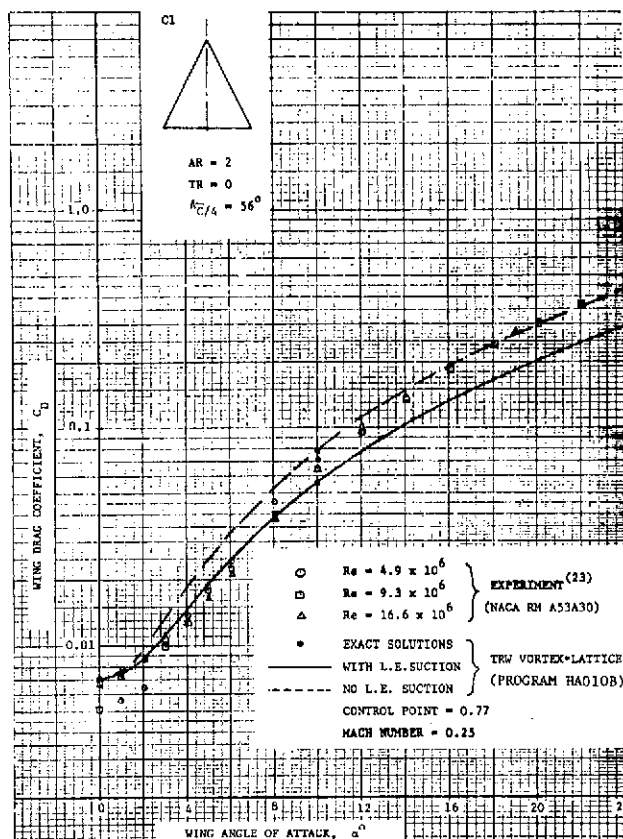
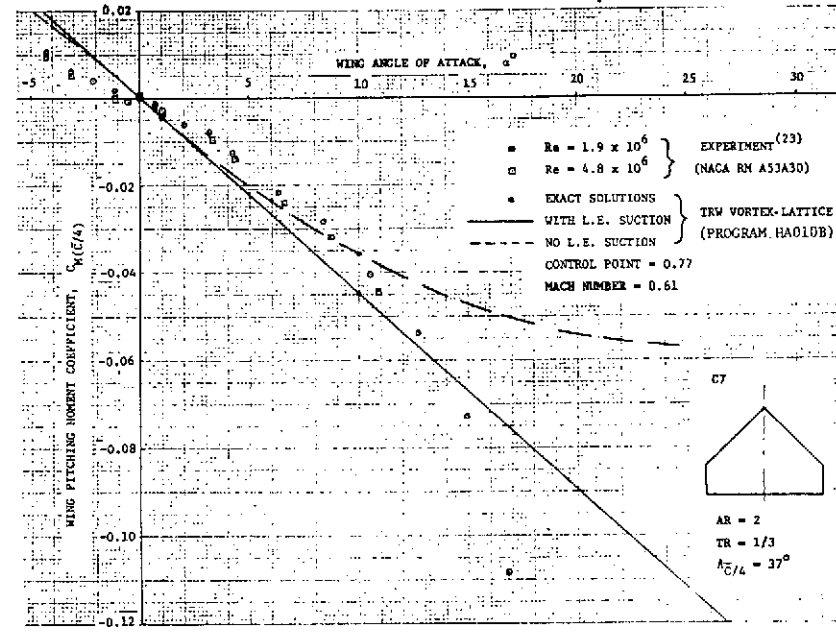
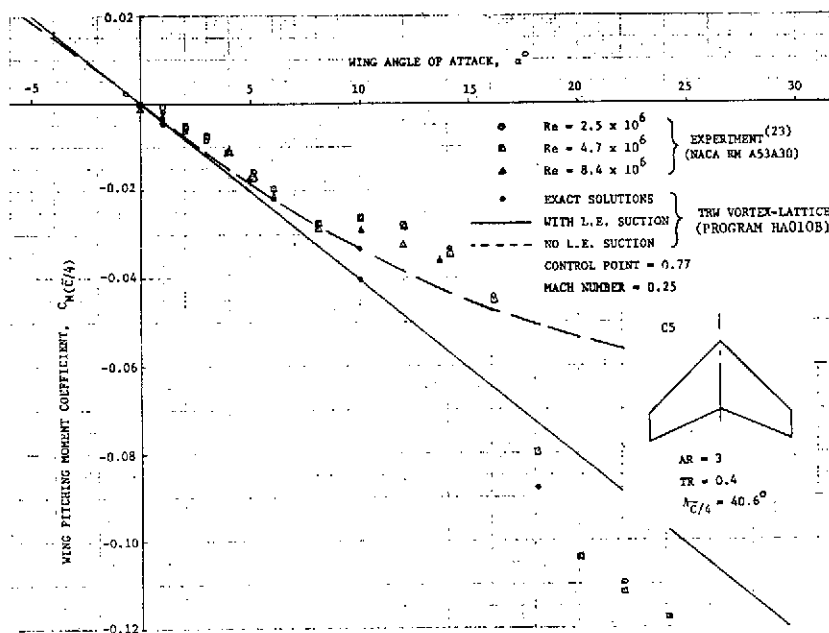
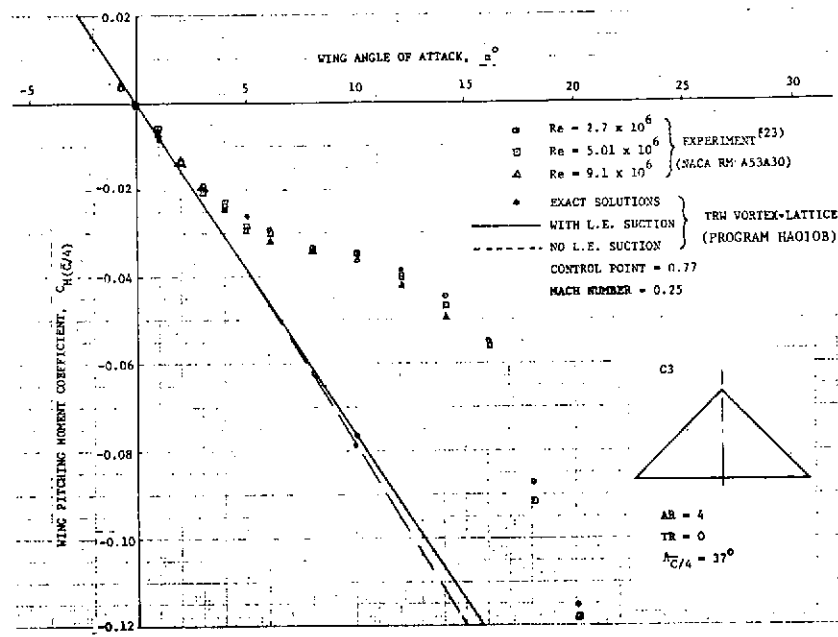
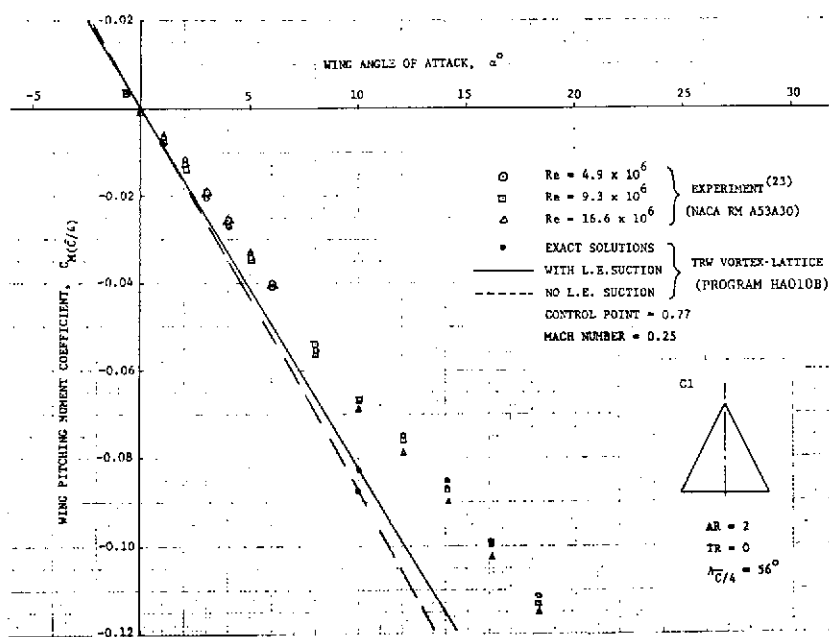


FIGURE 2.11 - INDUCED DRAG PREDICTION COMPARISONS FOR SELECTED LOW ASPECT RATIO WING PLANFORMS


 FIGURE 2.12 - PITCHING MOMENT ABOUT  $\bar{C}/4$  PREDICTION COMPARISONS FOR SELECTED LOW ASPECT RATIO WING PLANFORMS

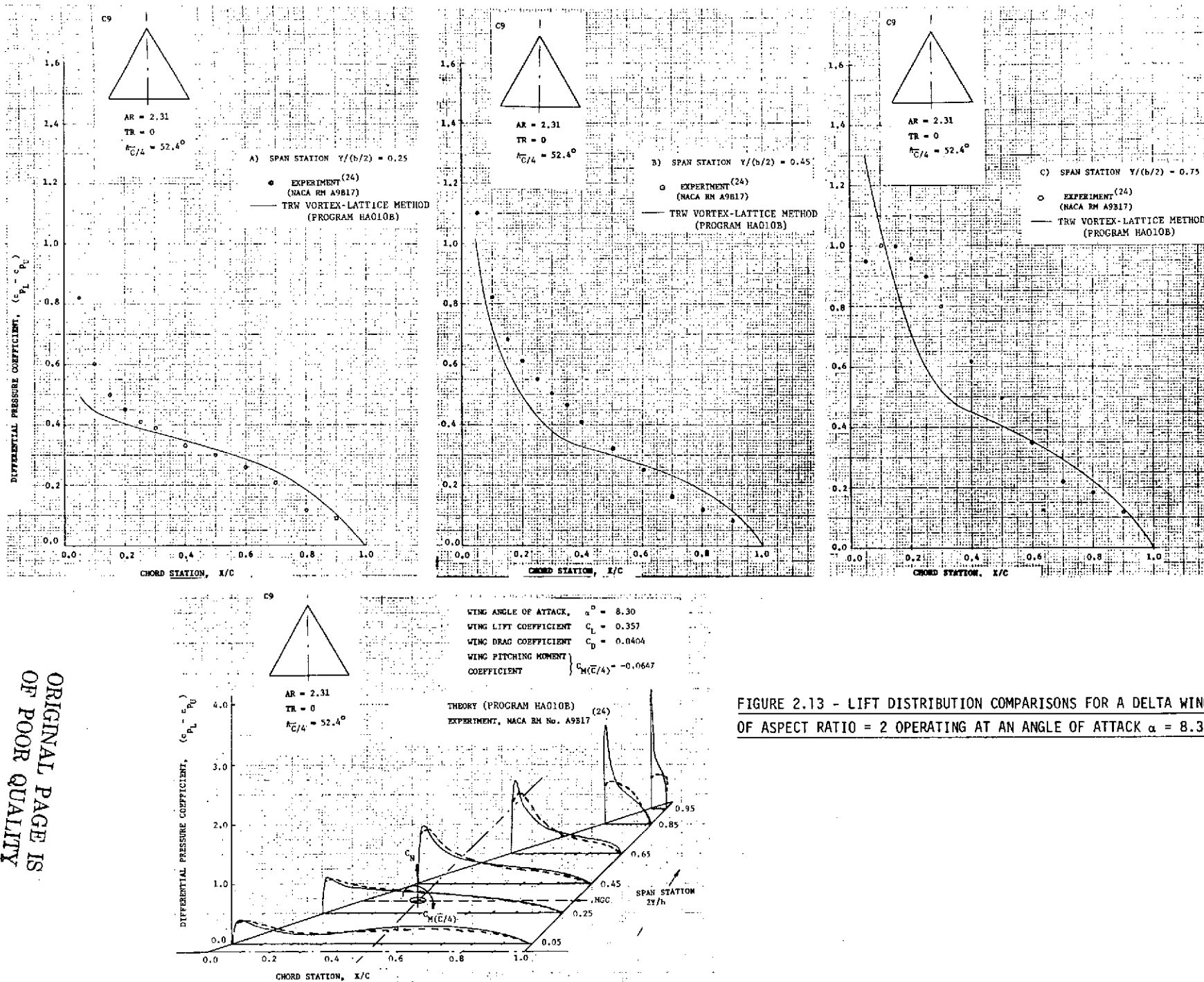


FIGURE 2.13 - LIFT DISTRIBUTION COMPARISONS FOR A DELTA WING OF ASPECT RATIO = 2 OPERATING AT AN ANGLE OF ATTACK  $\alpha = 8.30^\circ$

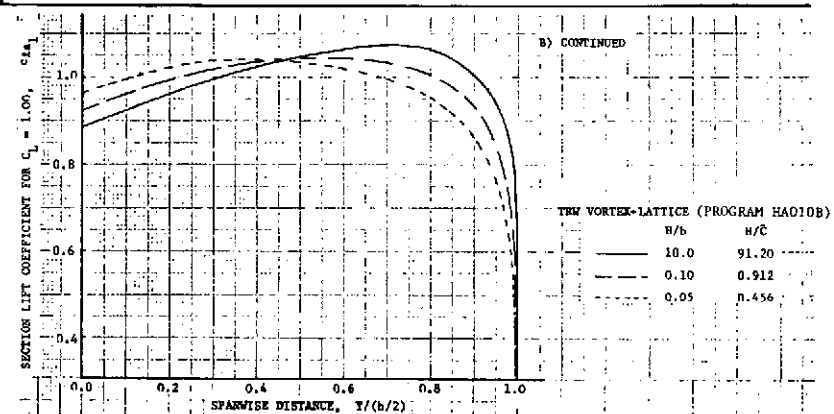
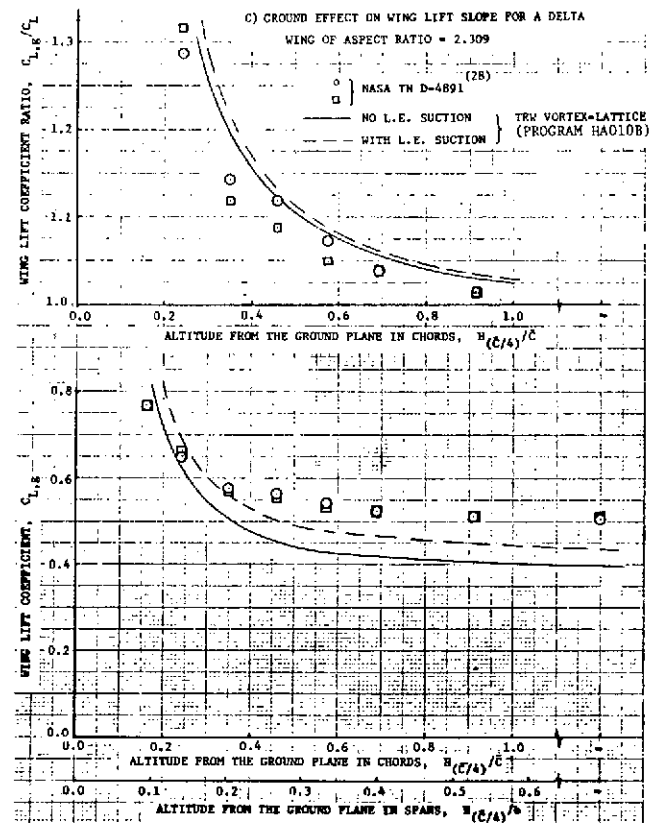
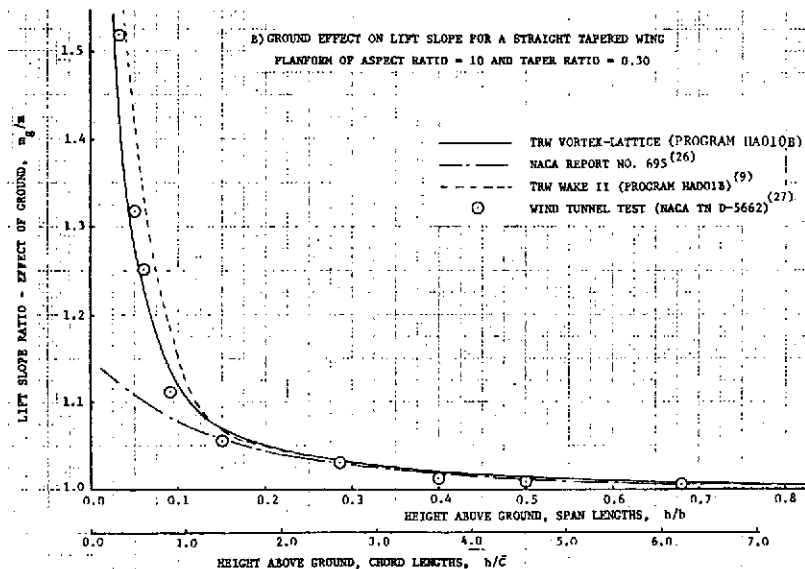
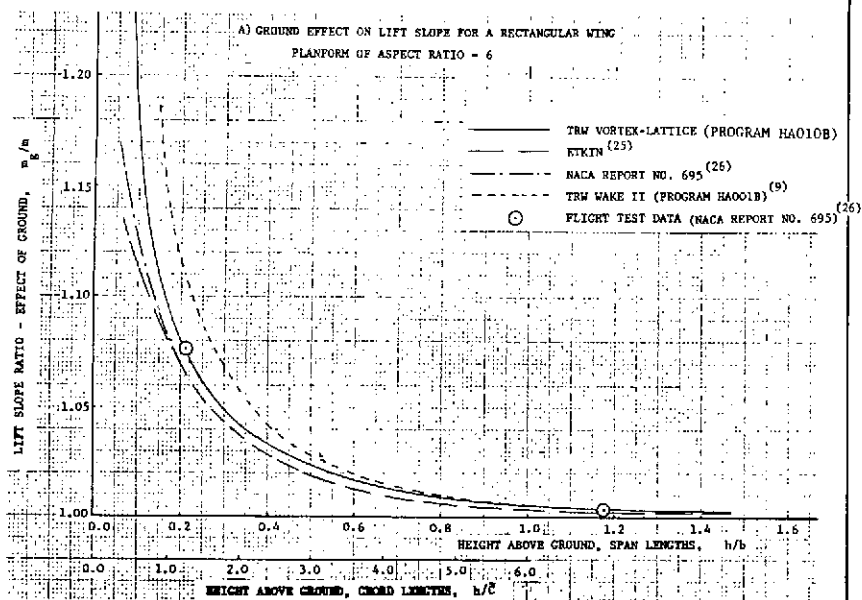
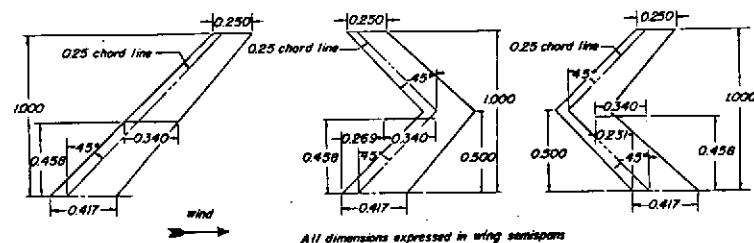
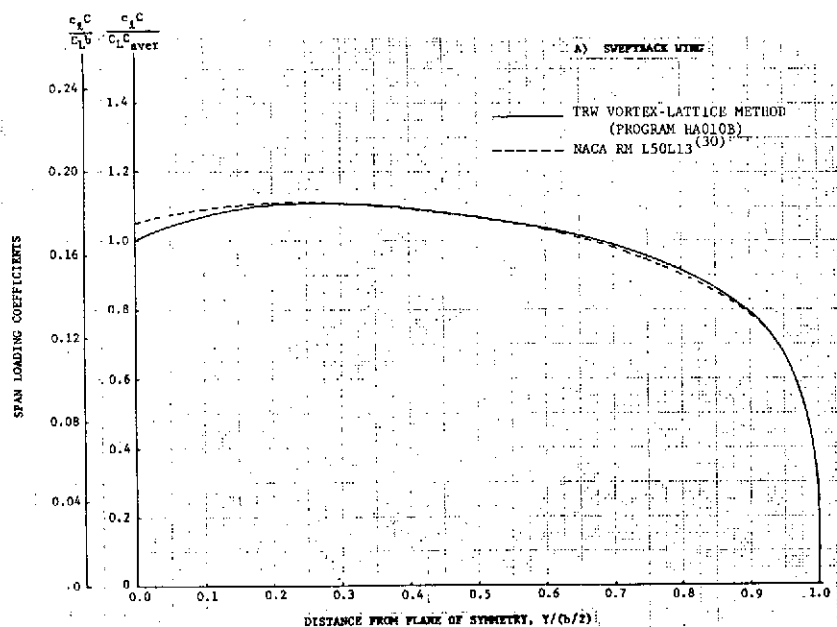


FIGURE 2.14 - WING LIFT PREDICTION COMPARISONS IN THE PRESENCE OF A VERY NEAR GROUND PLANE



Tabulated Wing Data

## Sweepback wing

Sweep  $45^\circ$   
Aspect ratio 6  
Taper ratio 0.6

## W-wing

Sweep of inboard panel  $45^\circ$   
Sweep of outboard panel  $45^\circ$   
Aspect ratio 6  
Taper ratio 0.6

## M-wing

Sweep of inboard panel  $45^\circ$   
Sweep of outboard panel  $45^\circ$   
Aspect ratio 6  
Taper ratio 0.6

ANALYTICAL METHOD	SWEEPBACK WING			W - WING			M - WING		
	LIFT SLOPE $C_L/\text{RADIAN}$	$\gamma_{C.P.}$	A. C. X	LIFT SLOPE $C_L/\text{RADIAN}$	$\gamma_{C.P.}$	A. C. X	LIFT SLOPE $C_L/\text{RADIAN}$	$\gamma_{C.P.}$	A. C. X
TRW VORTEX LATTICE* (PROGRAM HA010B)	3.1503	47.080	30.616	3.6636	45.034	31.917	3.4312	42.808	28.025
NACA RM L50L13 (30)	3.48**	46.7	27.5	3.55	43.9	31.4	3.53	43.7	26.4

\*CONTROL POINT =  $3/4$  CHORD OF ELEMENTAL PANELS AND VORTEX MATRIX  $\approx 20 \times 3$  WERE USED.  
\*\*PROBABLY PRINTED IN ERROR, SHOULD BE 3.23 ACCORDING TO NACA REPORT No. 921 (29)

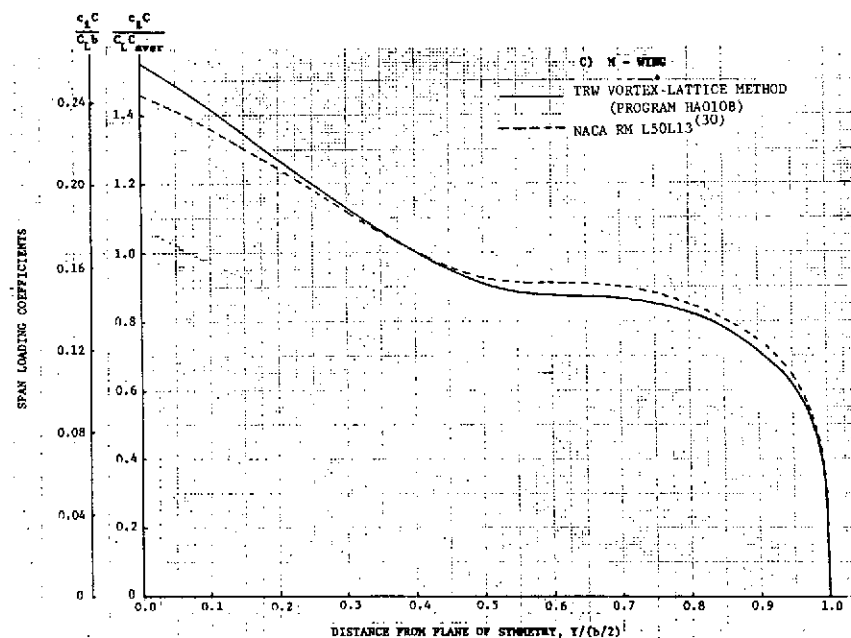
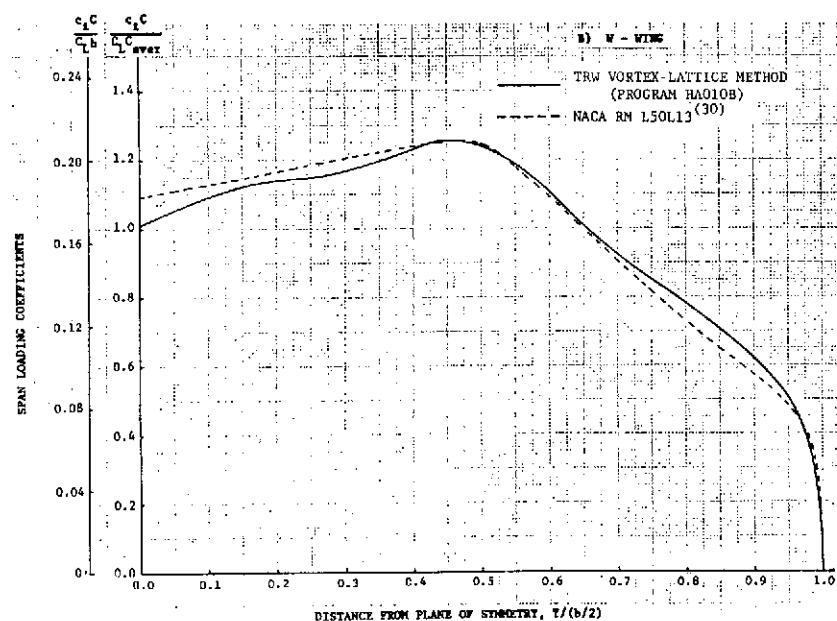


FIGURE 2.15 - LIFT DISTRIBUTION PREDICTION COMPARISONS FOR UNUSUAL WING PLANFORM CONFIGURATIONS

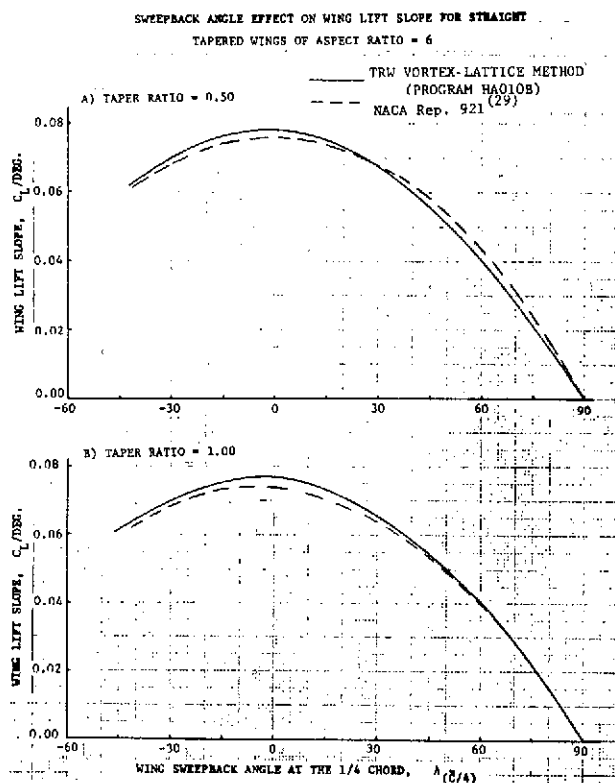


FIGURE 2.16 - SWEEPBACK ANGLE EFFECT ON THE MAGNITUDE OF THE WING-LIFT-SLOPE FOR TAPERED WING PLANFORMS OF ASPECT RATIO = 6

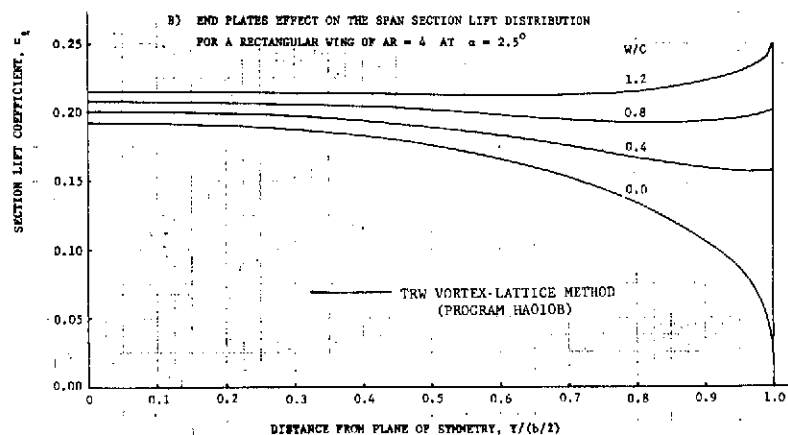
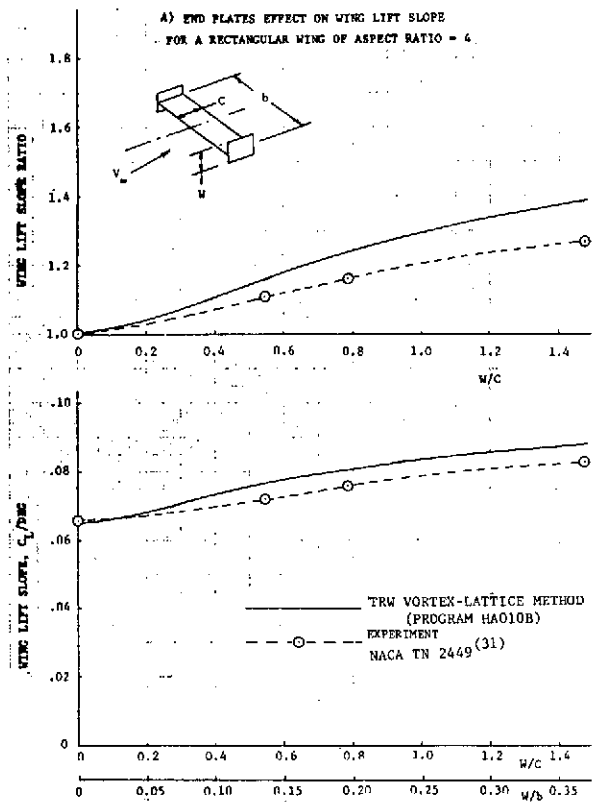


FIGURE 2.17 - WING LIFT PREDICTION COMPARISONS FOR A RECTANGULAR WING OF ASPECT RATIO = 6 WITH END PLATES

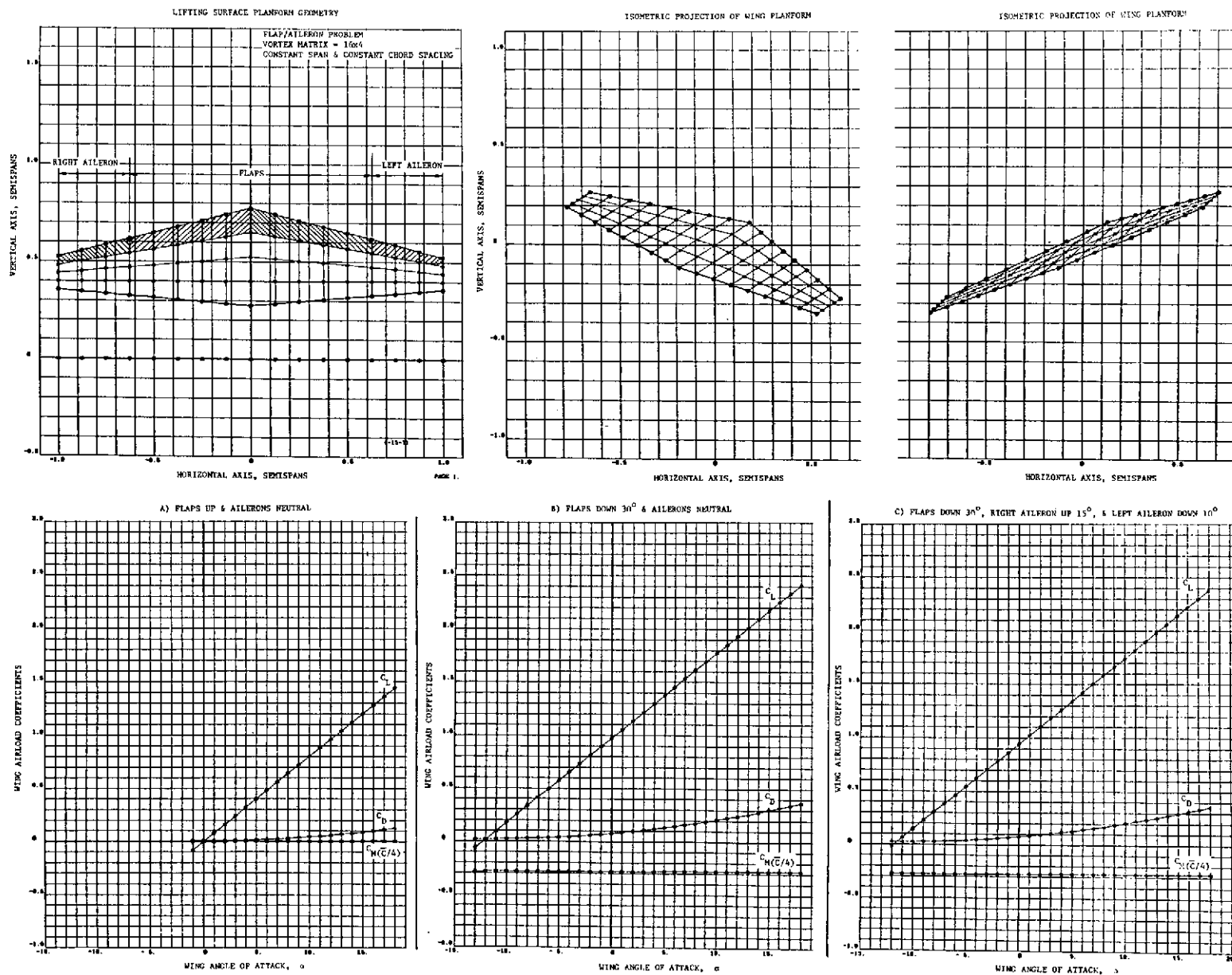


FIGURE 2.18 - AIRLOAD PREDICTIONS (PROGRAM HA010B) FOR A SELECTED STRAIGHT-TAPERED WING PLANFORM  
WITH GEOMETRIC TWIST DUE TO CONTROL SURFACE DEFLECTIONS



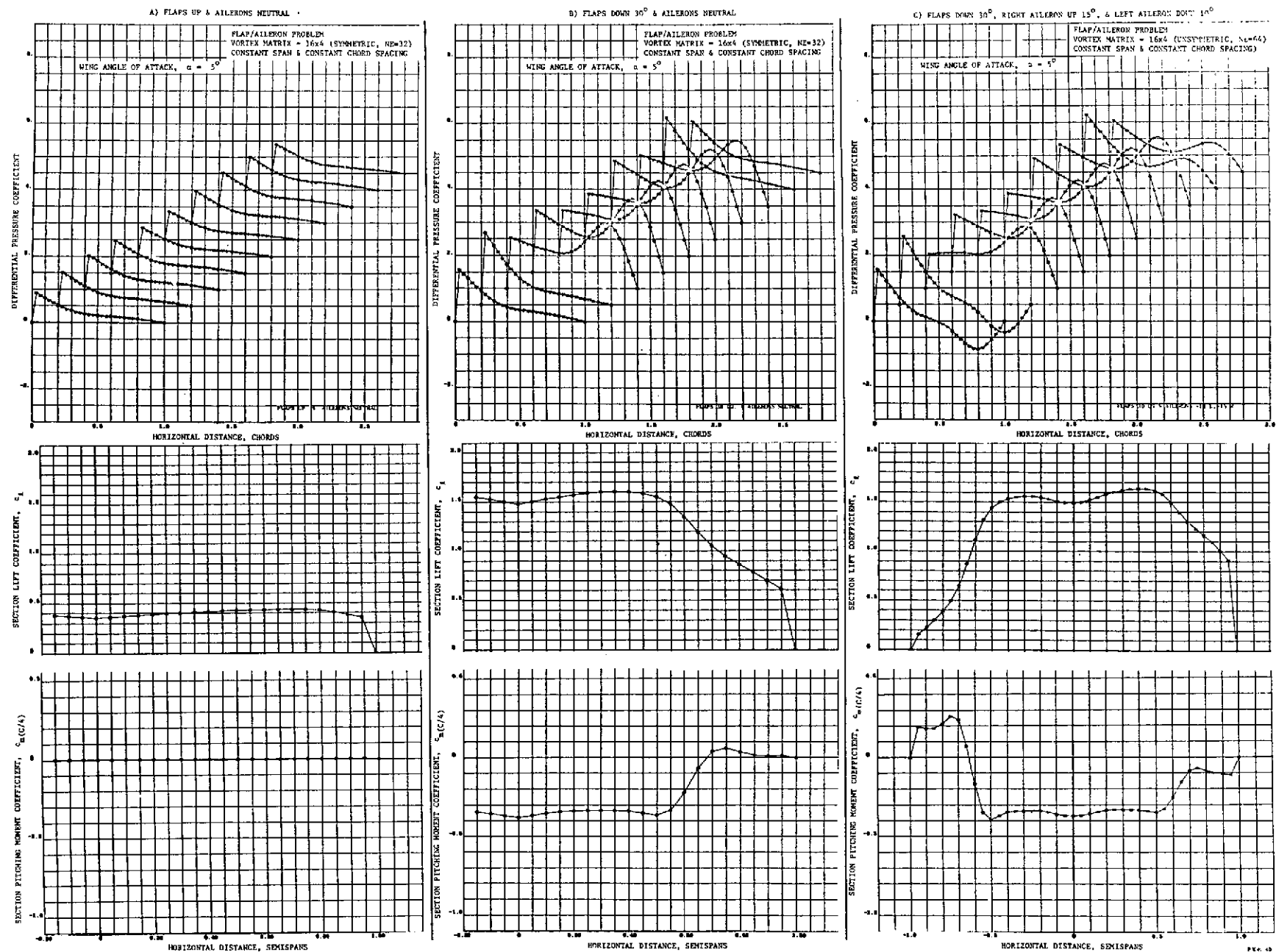


FIGURE 2.18 - AIRLOAD PREDICTIONS (PROGRAM HAIOB) FOR A SELECTED STRAIGHT-TAPERED WING PLANFORM WITH GEOMETRIC TWIST DUE TO CONTROL SURFACE DEFLECTIONS, CONTINUED.

2-51

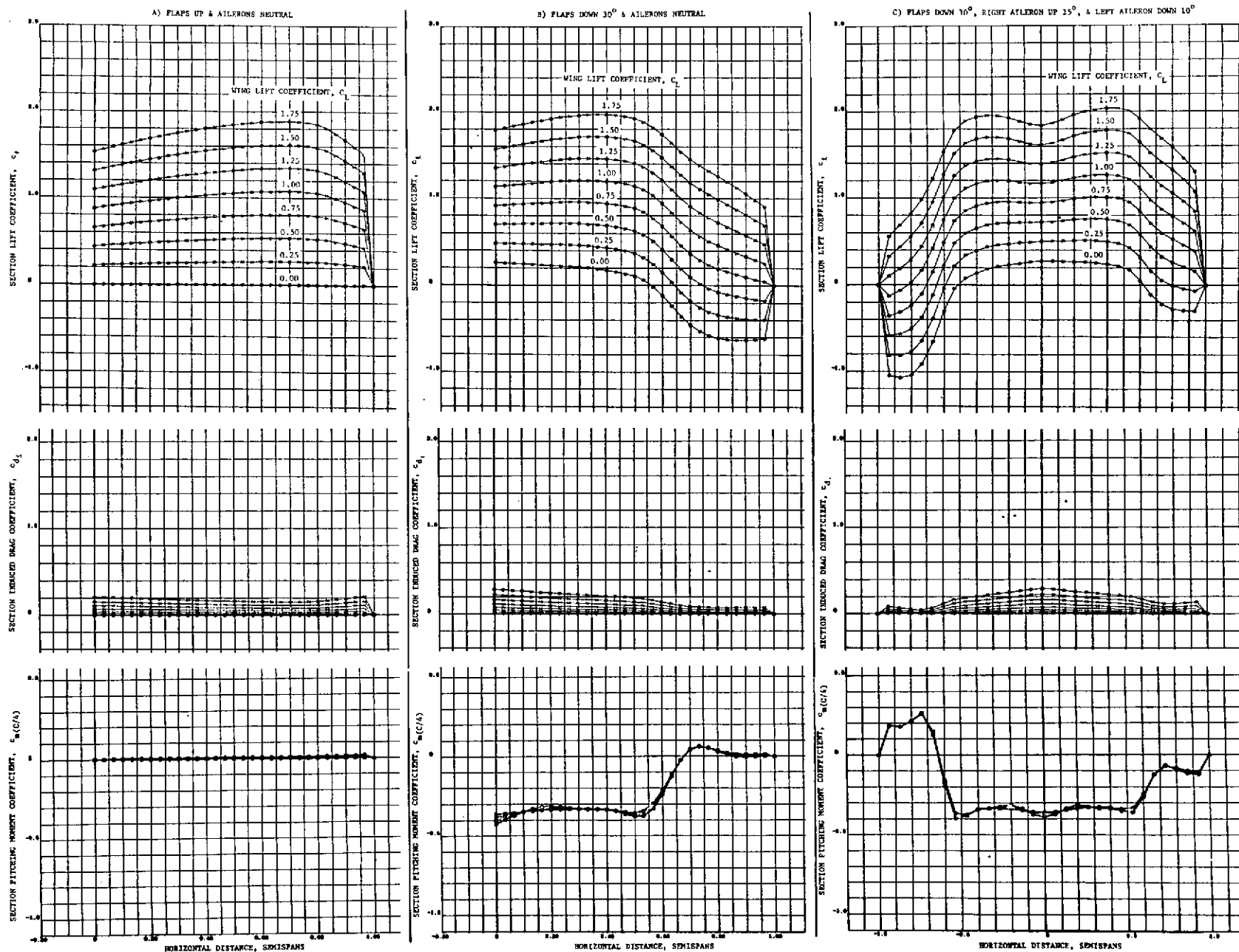


FIGURE 2.18 - AIRLOAD PREDICTIONS (PROGRAM HA010B) FOR A SELECTED STRAIGHT-TAPERED WING PLANFORM  
WITH GEOMETRIC TWIST DUE TO CONTROL SURFACE DEFLECTIONS, CONTINUED.

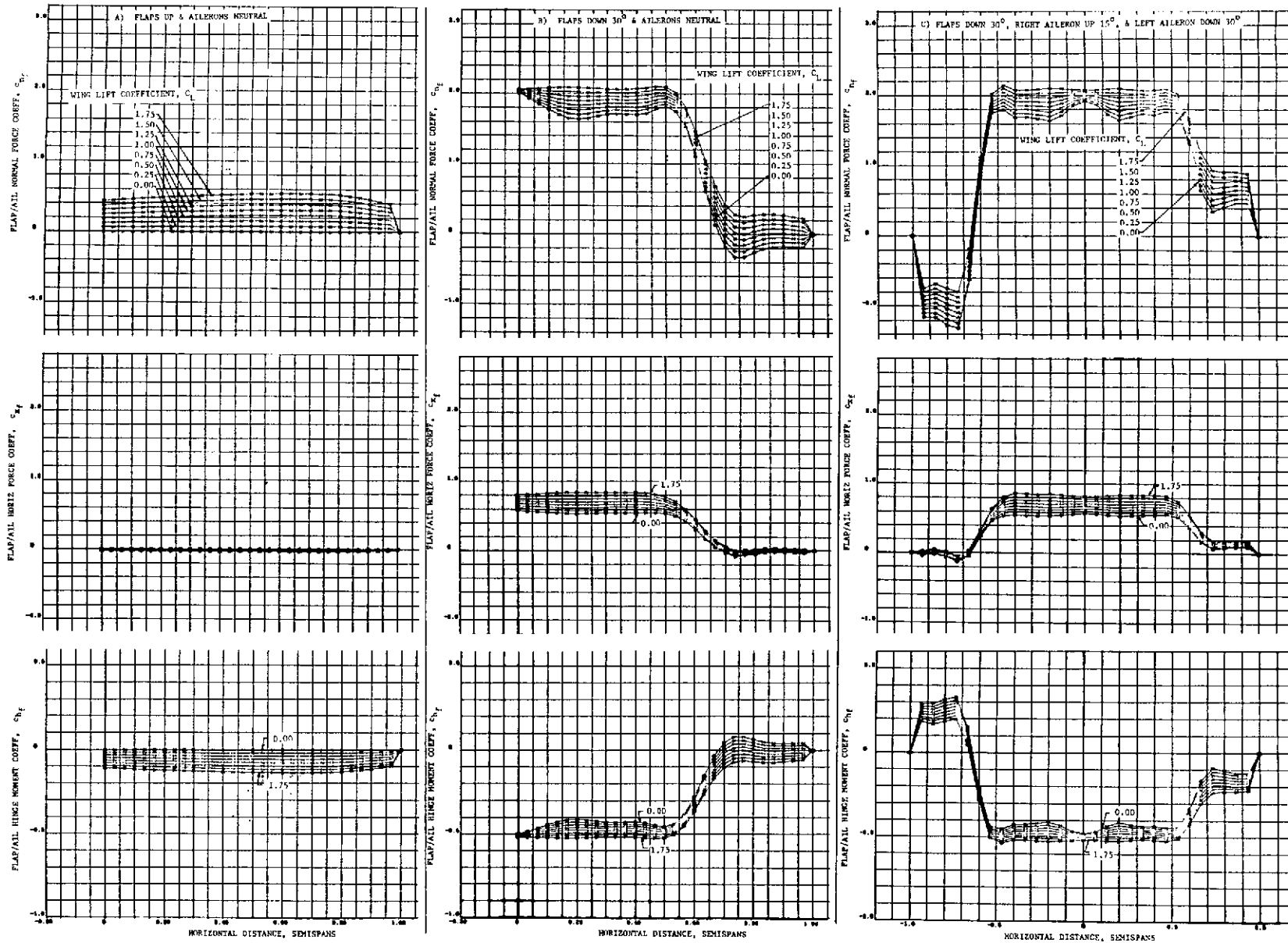
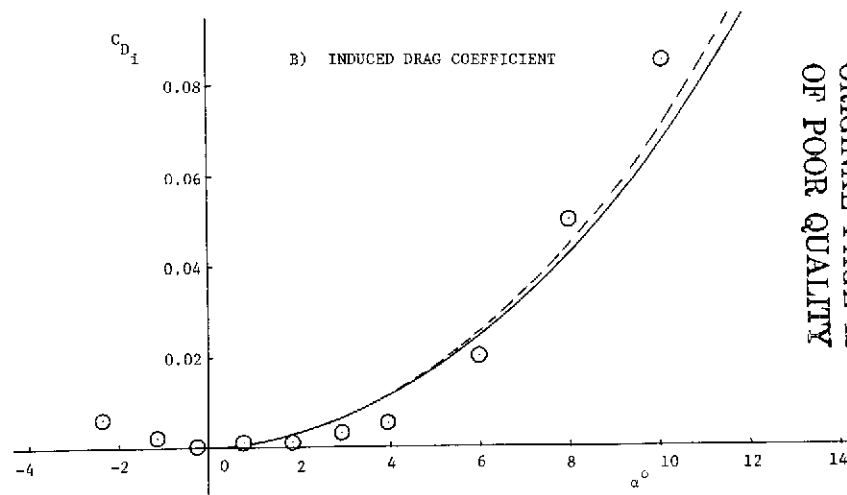
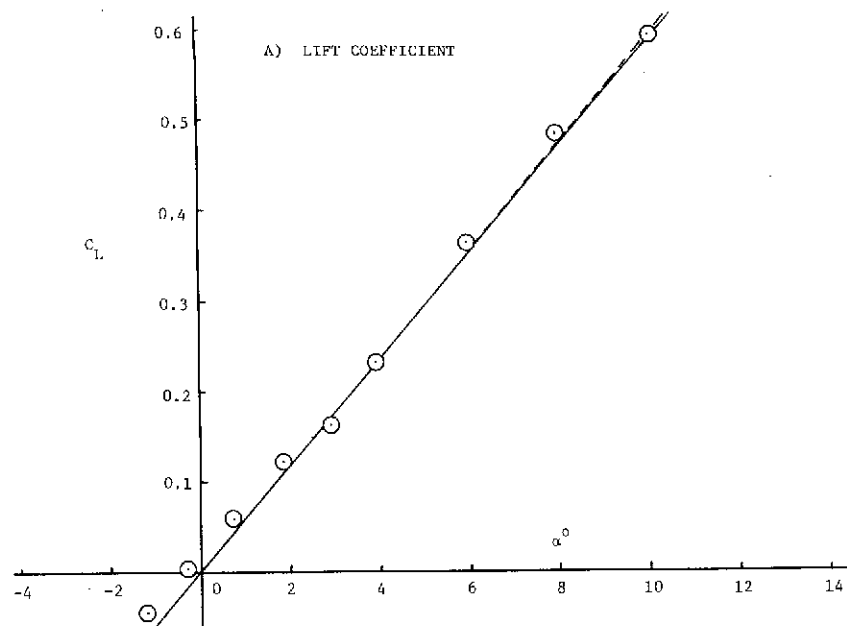
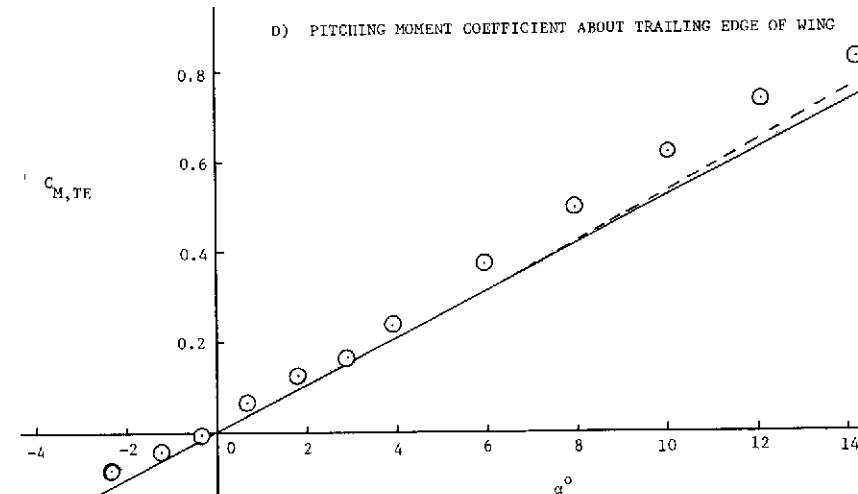
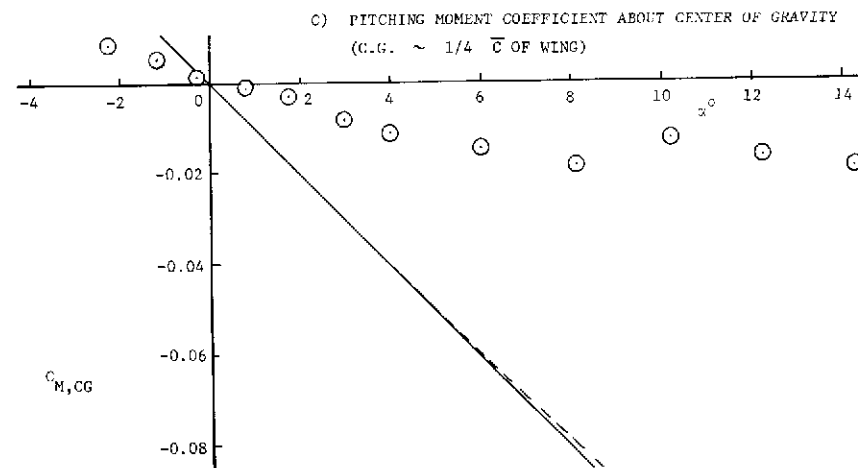


FIGURE 2.18 - AIRLOAD PREDICTIONS (PROGRAM HAQ10B) FOR A SELECTED STRAIGHT-TAPERED WING PLANFORM WITH GEOMETRIC TWIST DUE TO CONTROL SURFACE DEFLECTIONS, CONTINUED.



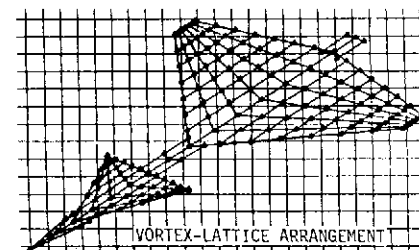
ORIGINAL PAGE IS  
OF POOR QUALITY



○ EXPERIMENT, NASA TM X-120<sup>(32)</sup>

— WITH L.E. SUCTION } TRW VORTEX-LATTICE METHOD  
- - - NO L.E. SUCTION } (PROGRAM HAO10B)

FIGURE 2.19 - MULTIPLE-SURFACE CONFIGURATION ANALYTICAL PREDICTIONS (PROGRAM HAO10B)  
COMPARED AGAINST WIND-TUNNEL TEST DATA



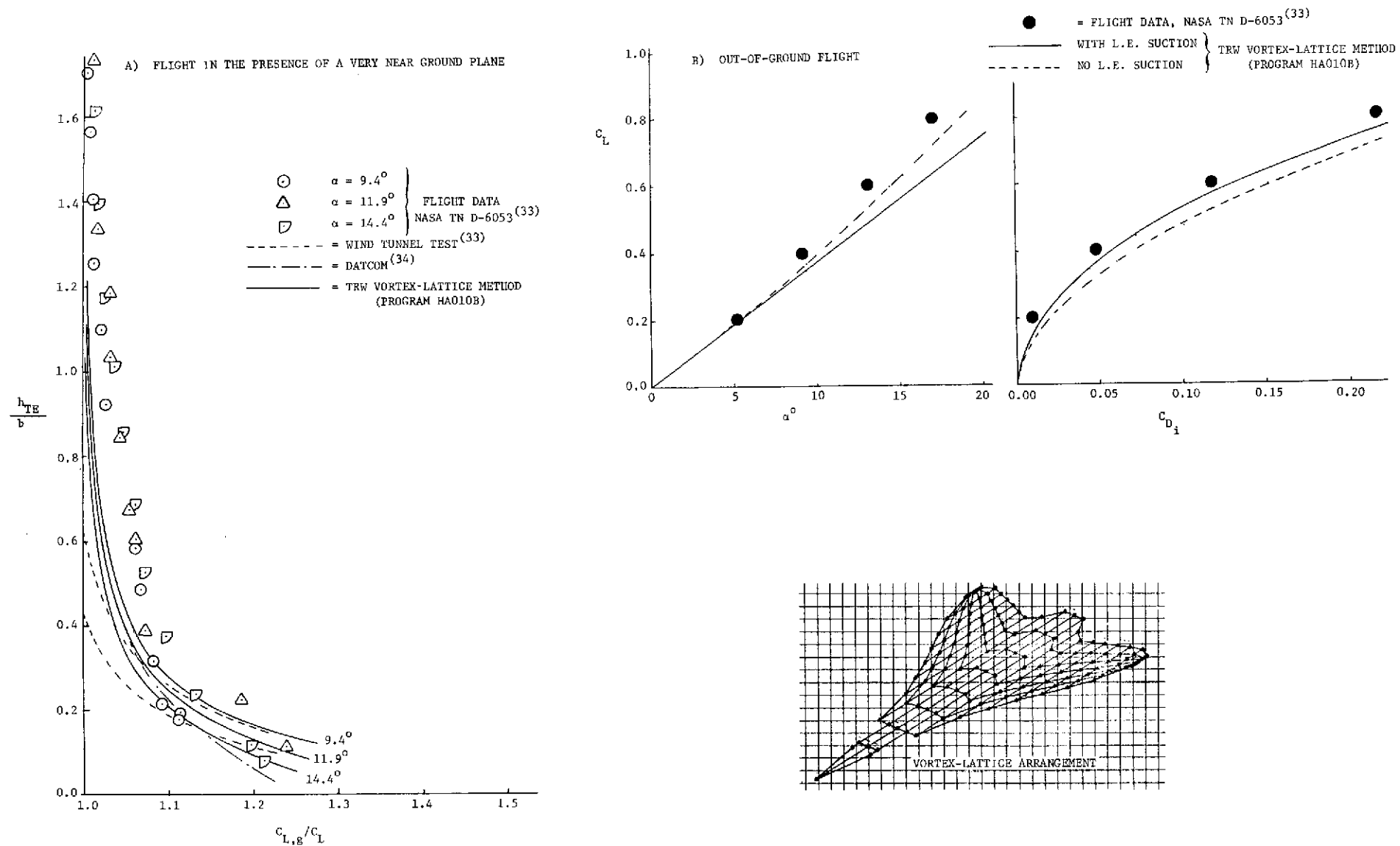


FIGURE 2.20 - MULTIPLE-SURFACE ANALYTICAL PREDICTIONS (PROGRAM HA010B) FOR THE DOUGLAS F5D-1 MODIFIED AIRPLANE WITH AN OGEE WING AND COMPARISONS AGAINST FLIGHT TEST DATA

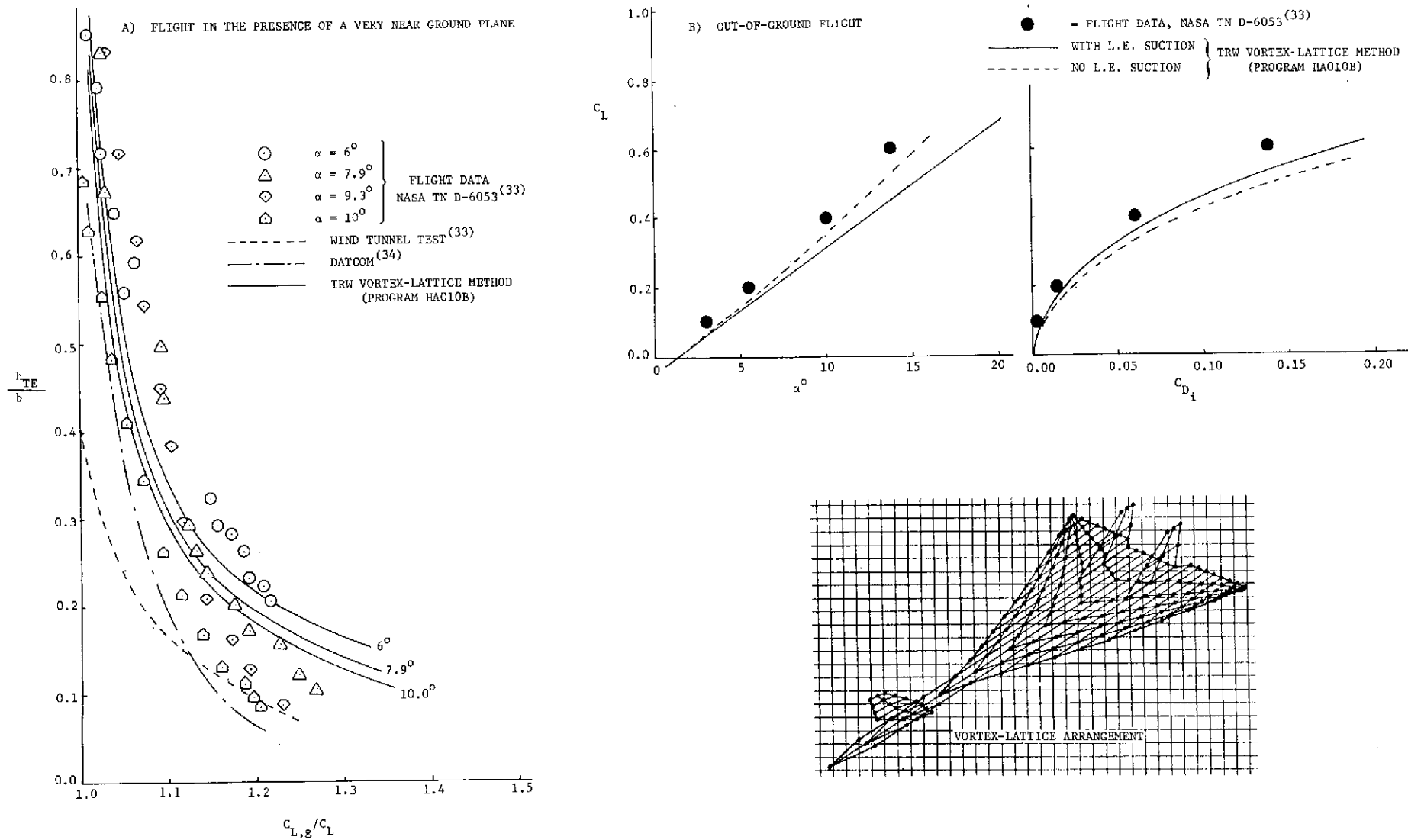


FIGURE 2.21 - MULTIPLE-SURFACE ANALYTICAL PREDICTIONS (PROGRAM HA010B) FOR THE NORTH AMERICAN XB-70 AIRPLANE AND COMPARISONS AGAINST FLIGHT TEST DATA

### 3.0 INPUT

#### 3.1 General Directions for Program Input

Five separate modes of execution are permitted for the TRW Vortex-Lattice Analysis Program #HA010B (N.SURFACE). These include:

- (1) two main execution modes for solving lifting-surface problems by the vortex-lattice method, i.e., SQT ISURF and NSURF execution,
- (2) two test execution modes for determining the accuracy of the matrix inversion procedure, i.e., XQT ISURFT and NSURFT execution,
- and (3) one auxiliary execution mode used for obtaining Calcomp or 4060-microfilm output, i.e., XQT TRWPLT execution.

##### 1) Main Execution Modes

Two main execution modes are permitted: XQT ISURF and SQT NSURF. These modes are used to analyze single- or multiple- lifting surface configurations respectively. Punched cards are used as the input media. NAMELIST statements and formatted statements are used exclusively. The input data is classified into groups, i.e., Group #1, Group #2, Group #3, and Group #4. A brief description of the information contained in each group and the arrangement order for input is given below:

<u>Group No.</u>	<u>Function</u>	<u>Contents</u>	<u>Type of Input</u>
#1 (START)	Execution Mode Card Mode = ISURF or NSURF	7/8 punch, space, XQT, space, mode	"A" format
#2	Job Identification (title) and Comments	1. Job Title (1 card) 2. Comments (3 cards)	"A" format "A" format
#3	Job execution controls and solution specifications	Namelist \$INPUT	NAMELIST
#4 (END)	Job/Jobs Termination	\$ENDJØBS	"A" format

##### 2) Test Execution Modes

Two test execution modes are permitted: XQT ISURFT and SQT NSURFT. These two modes are used to determine the accuracy of the matrix inversion procedure for the ISURF and NSURF execution modes respectively. Only the execution mode card is required for input for the test execution modes, as follows:

### 3.1 General Directions for Program Input (Continued)

<u>Group No.</u>	<u>Function</u>	<u>Contents</u>	<u>Type of Input</u>
#1 (ONLY)	Execution Mode Card Mode = ISURFT or NSURFT	7/8 punch, space XQT, space, mode	"A" format

#### 3) Auxiliary Execution Mode

One auxiliary execution mode is permitted: XQT TRWPLT. This execution mode is contained in the second file of the program PCF tape and is used to generate Calcomp or 4060-microfilm output. The required input consists of the TRWPLT input instructions and a data tape. The description of the preparation of the input instructions is presented in Reference 35. The format and contents of the data tape which is generated in the execution of the main execution modes of the program is described under "Tape Output" in Section 5.3.

In preparing the program input (the main execution modes) the following conventions must be observed:

1. The first input card per case should be placed immediately following the XQT MODE card for the first case or behind the last card of the previous case for multiple case input. Blank cards between cases or input data groups should not be included in the input data deck.
2. For each case the arrangement of the input data must be ordered by groups, i.e., Group #1, Group #2, Group #3 and Group #4.
3. The last card of the input data deck is the end of jobs card (Group #4). This card must have \$ENDJOBS on it only (Columns 2-9).
4. For namelist input, the first card must have the namelist on it only (i.e., \$INPUT in columns 2-7).
5. For namelist input, data cards must be punched between columns 2-80. Continuation cards may be freely used by starting on the next line where the previous line left off. Every card must terminate with a comma (,). Variables that are input via NAMELIST must be dimensioned, for example:

NSS(1) = 8,

X(1) = 10, 15, 15, 20, 20, 20, 30,....



### 3.1 General Directions for Program Input (Continued)

There is no fixed order in which the variables are to be entered. They may be grouped at the user's discretion. The following abbreviations may be used for repeating fields in a table:

$X(1) = 10, 2*15, 3*20, 30, \dots$  is equivalent to  
 $X(1) = 10, 15, 15, 20, 20, 20, 30, \dots$  or  
 $X(1) = 10, \quad X(4) = 3*20, \quad X(2) = 2*15, \dots$  etc.

6. For namelist input, the last card must have \$END on it only (Columns 2-5).
7. Differentiation between similar looking characters: To avoid confusion due to the similarity in appearance of certain characters, the following rules should be followed:
  - a. The alphabetic I is used as opposed to the numeric 1 (one).
  - b. The alphabetic Z is written Z as opposed to the numeric 2 (two).
  - c. The alphabetic O is written Ø as opposed to the numeric 0 (zero).

The detailed input instructions and definitions of all input quantities for the program are presented in this section in the following sequence: 1) program input setup guide (Pages 3-8, 3-9), 2) program input instructions (Pages 3-10 through 3-17), AND 3) an alphabetical list of all input quantities (Pages 3-18 through 3-20). In addition, the following information that is related to the preparation of the program input is found in the following sections or figures of this report:

- 1) Vehicle Geometry Sign Convention:  
see Figure 3.01, Page 3-4.
- 2) Vortex-Lattice Arrangement Restrictions:  
see Section 3.2.
- 3) Input Card-Deck-Setup Examples:  
see example problems, Section 6.1.
- 4) Control Deck Setup:  
see Figure 7.02.
- 5) Execution Time:  
see Section 7.2

### 3.1 General Directions for Program Input (Continued)

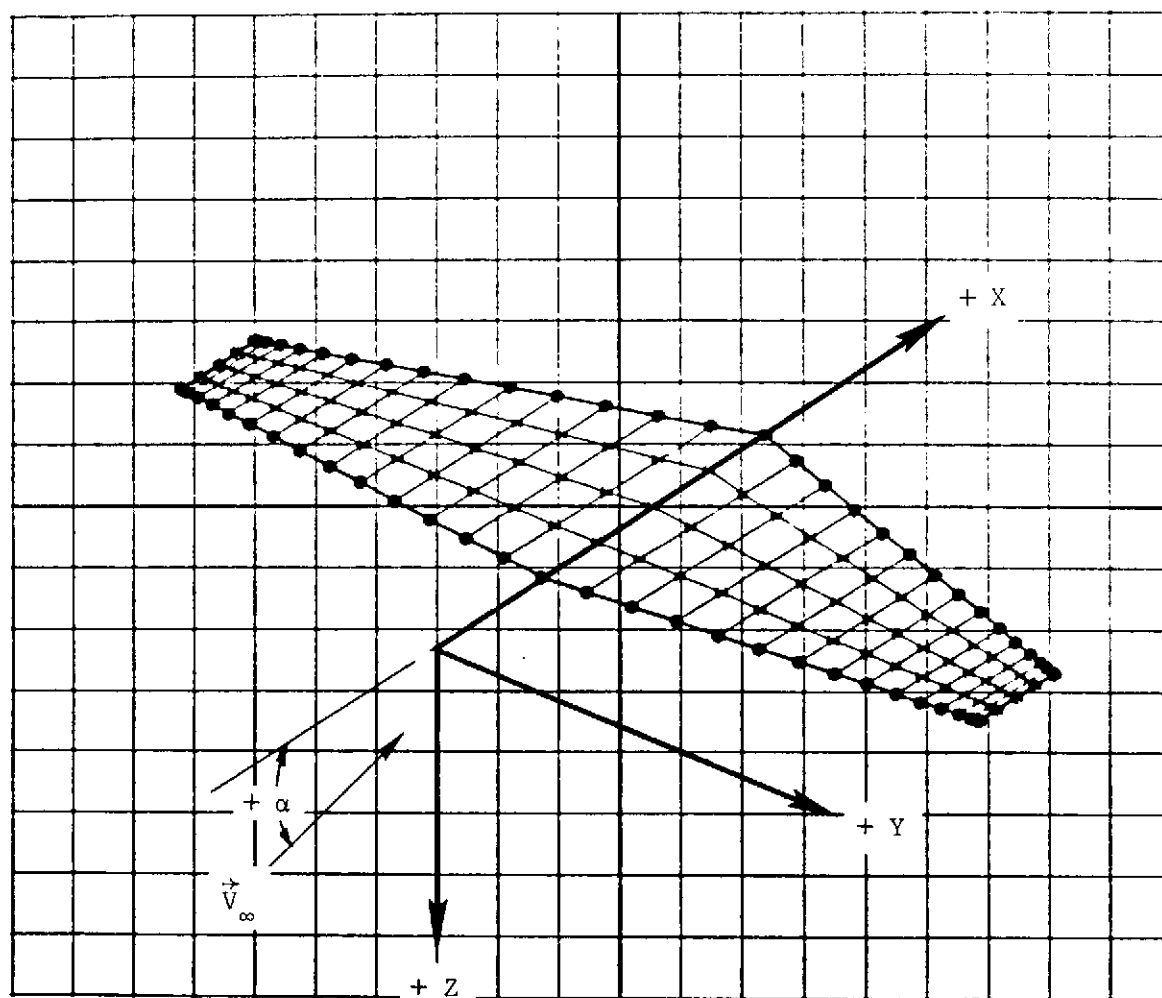


FIGURE 3.01 - LIFTING-SURFACES INPUT GEOMETRY SIGN CONVENTION  
(RIGHT HANDED COORDINATE SYSTEM)

### 3.2 Vortex-Lattice Arrangement Restrictions

The configuration of the vortex-lattice or arrangement of elemental panels that is specified in the input determines the validity of the solutions. In general, bad solutions are obtained when the number of elemental panels that determines the vortex-lattice arrangement is insufficient to properly represent the problem geometry. Other sources that lead to bad solutions are: the presence of sharp discontinuities in the lifting-surfaces geometry, unequal panel dimensions for adjacent elemental panels, and improper spacing of trailing vortices shed from forward surfaces that impinge on rear surfaces. The indicators that warn of the presence of bad solutions are:

1. The drag calculated for the sum of the total number of surfaces considered in a solution is negative. Although, negative drag is not always a good indicator for bad solutions because its magnitude is generally much smaller than the lift and therefore subject to more severe numerical roundoff errors, positive drag is unquestionably always an indicator of a good solution.
2. The calculated lift versus angle of attack curve is not smooth. The source of the errors that led to a bad solution can be determined by examining the magnitude of the calculated circulation for the vortex filaments or the spanwise lift distribution (see Figures 5.3 and 5.8).
3. The calculated values for lift and drag are out of range, i.e., the solution blew.

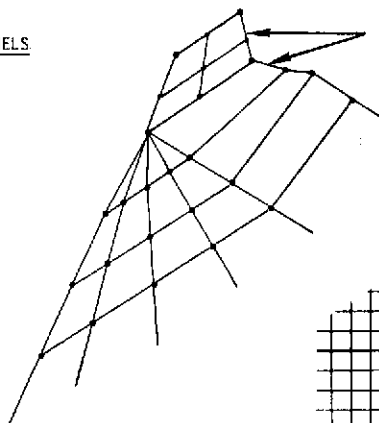
In the opposite side, a solution or a set of solutions may be considered to be good if by increasing the number of elemental panels or rearranging the configuration of the vortex-lattice by a small amount leads to a negligible variation of the magnitude of the calculated airload coefficients. It should be noted that: "there is no shortcut or formula presently available that, if followed, will always guarantee the generation of good solutions." The program user should be aware of this fact and should follow good judgement based on experience in aerodynamics in assessing the validity of the vortex-lattice solutions that he generates.

### 3.2 Vortex-Lattice Arrangement Restrictions (Continued)

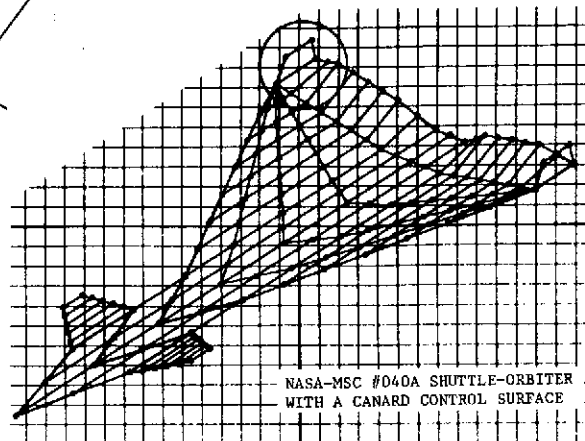
As a guide to engineers using the vortex-lattice analysis method for the first time, the user should adhere to the following general directions:

1. The larger the number of elemental panels used for representing a given lifting-surface configuration, the more accurate will be the solutions that will be obtained.
2. Adjacent panels should be of approximately equal size and should have approximately the same configuration, i.e., the variation in size and configuration between adjacent panels should be as small as possible (Figure 3.02[A]).
3. The width of panels in a column of one or more lifting surfaces should be exactly the same and must line up perfectly (Figure 3.02[B]). This requirement arises because of the approximate representation of the vorticity distribution on the lifting surfaces by discrete-size vortex filaments that are used in the vortex-lattice method. Note that the trailing vortices must lie equidistant to the co-location points in a row of elemental panels downstream. As a special feature of the program (TRW Vortex-Lattice Analysis Program #HA010B), the trailing vortices can be located exactly in line with a column of co-location points (Figure 3.02[C]). In this instance, the velocity induced by these vortices at the co-location points (which may be indefinite) is simply ignored.

A) SIZE OF ADJACENT PANELS

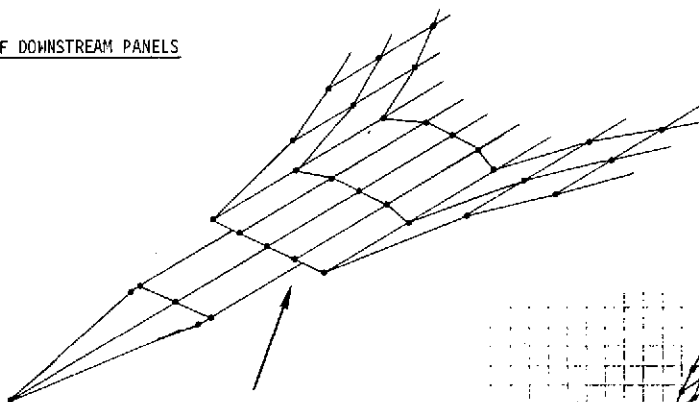


ERROR: THE SIZE OF THE FIN PANELS DOES NOT MATCH THE SIZE OF THE ADJACENT WING PANELS.

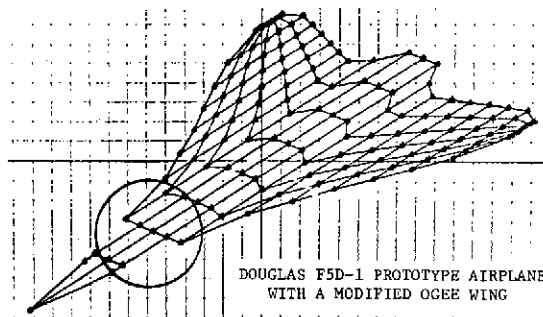


NASA-MSC #040A SHUTTLE-ORBITER  
WITH A CANARD CONTROL SURFACE

B) WIDTH OF DOWNSTREAM PANELS

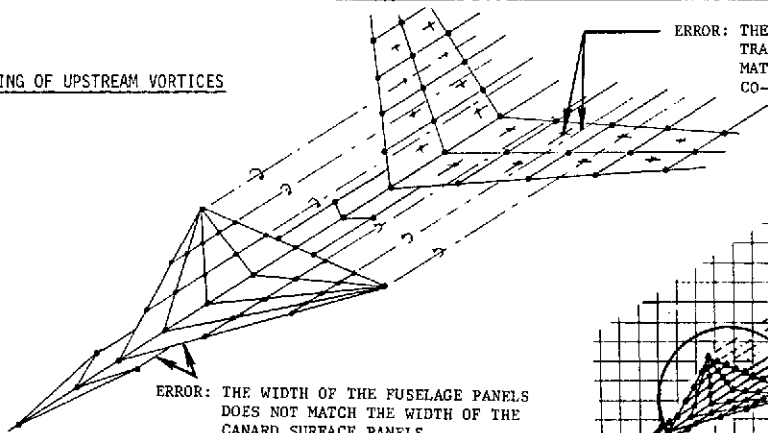


ERROR: THE SIZE OF THE FUSELAGE PANELS DOES NOT MATCH THE WIDTH OF THE WING PANELS

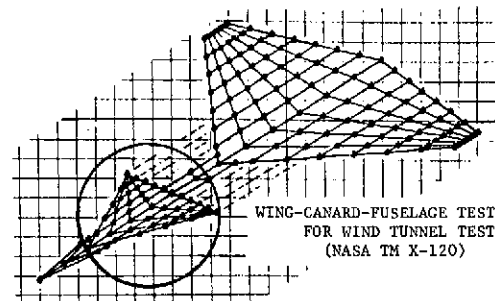


DOUGLAS F5D-1 PROTOTYPE AIRPLANE  
WITH A MODIFIED OGEE WING

C) SPACING OF UPSTREAM VORTICES



ERROR: THE SPACING OF THE CANARD SURFACE TRAILING-EDGE VORTICES DOES NOT MATCH THE SPACING OF THE WING CO-LOCATION POINTS.



WING-CANARD-FUSELAGE TEST MODEL  
FOR WIND TUNNEL TEST  
(NASA TM X-120)

FIGURE 3.02 - ILLUSTRATION OF POOR VORTEX-LATTICE ARRANGEMENT  
OVERSIZED INSERTS ARE SHOWN IN ERROR

### 3.3 PROGRAM INPUT SETUP GUIDE

```

▽ 2 RUN 54589,TRW,0001,3303A,0001,P,3,1
▽ N MSG      FILE REQ.  TAPE 1 FH432 3 FSTRN 1
▽ ASG X=A10202
▽ ASG F
▽ PLT
▽ XQT CUR
  TRW X
  ERS
  IN X
  PEF X
  TRI X
  TQC
▽ XQT MØDE    (MØDE= NSURF OR ISURF)
  JØB TITLE FØR JØB 1 (1 CARD)
  COMMENTS,REQUIRED FØR JØB 1 (3 CARDS)
  $INPUT
  NFLG,IFLG,
  KØUT,KT1,KT2,KT3,LINX,
  NWING,NFUS,NVTAIL,
  NSS,X,Y,Z,E,C,XØCR,YSPAN,
  NCS,XØC,ZØC,
  WFLAP1,WFLAP2,WFLAP3,FLAPC,TABC,FLAPDJ,TABDJ,AILDJ,
  XCG,YCG,ZCG,REFS,REFC,REFB,GSCALE,
  NJØB,ALFA,MACHN,HEIGHT,FLAPDJ,AILDJ,NSØLV,
  NJØBL,WCL,
  CØLØCP,WSMØTH,LFLAP,LDRAG,CLEANF,PMECF,CUTØF1,CUTØF2
  $END
  JØB TITLE FØR JØB 2 (1 CARD)
  $INPUT
  NAMELIST DATA
  $END
  $ENDJØBS
▽ XQT TRWPLT
  KUNIT = 8
  ICCØMP= 0
  NTRAN = 0
  IPRINT= 0
  NTYPE = 0
  NØFSCL= 1
  ISCALY = 1,1,1,1,1,1,1,1,1,1
  NXL = 24
  NXR = 24
  NYL = 24
  NYH = 24
  NPØSN1 = 600, 950
  NPØSN2 = 600, 925
  NPØSN3 = 600, 900
  NPØSN4 = 600, 90
  CHARSZ = 1,0,1,0,1,0,1,0

```

JOB CARD  
MESSAGE CARD  
 PROGRAM PCF TAPE NO,  
 REQUIRED IF TRW PLOT  
 OPTION IS USED  
 READ-IN PROGRAM CARDS  
 (LOAD THE PROGRAM)

↓  
 (IF PLOT OPTION USED)

EXECUTION MODE CARD  
 JOB TITLE-START JOB 1  
 COMMENTS  
 START NAMELIST \$INPUT  
 JOB-EXECUTION FLAGS  
 OUTPUT SPECIFICATIONS  
 LIFTING SURFACE TYPE  
 LIFTING SURFACES PLAN  
 AIRFOIL SECTION  
 FLAP-TAB-AILERONS  
 REFERENCE DIMENSIONS  
 FLIGHT ATTITUDE SPECS  
 LINEARIZED THEORY  
 OPTIONAL INPUT CONST.  
 END NAMELIST \$INPUT  
 JOB TITLE-START JOB 2  
 START NAMELIST \$INPUT  
 DATA FOR JOB 2  
 END NAMELIST \$INPUT  
 END OF ALL JOBS  
EXECUTE PLOT OPTION  
PLOT EXEC, CONSTANTS

▽ = 7/8 PUNCH.

NOTE: THE FOLLOWING CONTROL CARDS ARE OPTIONAL FOR INPUT

▽ N MSG = MESSAGE CARD (REQUIRED FOR NASA-MSC)

▽ PLT = REQUIRED FOR PLOT OUTPUT

INPUT INSTRUCTIONS FOR THE CALCOMP/4060-MICROFILM PLOT-OUTPUT OPTION, XQT TRWPLT, ARE FOUND IN REFERENCE 35. THESE INSTRUCTIONS HAVE BEEN OMITTED IN THE PRESENT REPORT.

### 3.3 PROGRAM INPUT SETUP GUIDE (CONTINUED)

```

ANNØT1 = 10 = EXAMPLE PRØB. 1 - MULTIPLE-SURFACE
ANNØT2 = 10 = CAPABILITY DEMØNSTRATION RUN
ANNØT3 = 10 = A.GØMEZ/ 5 JULY 72
ANNØT4 = 10 =
TITLE = 10 = ISØMETRIC PRØJECTION ØF LIFTING SURFACES
XLABEL = 10 = HORIZØNTAL AXIS, SEMISPANS
YLABEL = 10 = VERTICAL AXIS SEMISPANS
XHI= 1.5
XLØ=-1.0
YHI= 1.5
YLØ=-1.0
PLØT = 2,1, 3,1, ENDLST
ENDPLT
ANØTSV = 0
NØADV = 1
PLØT = 5,1, 6,1, ENDLST
ENDPLT
NØADV = 1
PLØT = 2,2, 3,2, ENDLST
ENDPLT
NØADV = 1
PLØT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
NØADV = 1
PLØT = 2,1, 3,1, ENDLST
ENDPLT
NØADV = 1
PLØT = 5,1, 6,1, ENDLST
ENDPLT
NØADV = 1
PLØT = 2,2, 3,2, ENDLST
ENDPLT
NØADV = 1
PLØT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
ENDRUN
VEØF

```

ANNOTATIONS (EXAMPLE)



PLOT LABELS (EXAMPLE)



PLOT SCALE (EXAMPLE)



PLOT INSTRUCTIONS  
FOR 1ST. FILE



PLOT INSTRUCTIONS  
FOR 2ND. FILE,..ETC.



END OF PLOTS CARD  
END CARD (LAST CARD)

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OF POOR QUALITY

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### 3.4 INPUT INSTRUCTIONS

---

#### GROUP 1 - EXECUTION MODE CARD.

\* FIVE SEPARATE EXECUTION MODES ARE PERMITTED \*

---

- (1) ▽ XQT NSURF (COLUMNS 1-11) 1 TO 5 LIFTING SURFACES MAY BE CONSIDERED SIMULTANEOUSLY.
- (2) ▽ XQT ISURF (COLUMNS 1-11) ONLY 1 LIFTING SURFACE MAY BE CONSIDERED WITH OR WITHOUT LINEARIZED LIFT OPTION.
- (3) ▽ XQT NSURFT (COLUMNS 1-12) MATRIX INVERSION TEST FOR XQT NSURF MODE.
- (4) ▽ XQT ISURFT (COLUMNS 1-12) MATRIX INVERSION TEST FOR XQT ISURF MODE.
- (5) ▽ XQT TRMPLT (COLUMNS 1-12) PLOT OPTION (REFERENCE 35)

#### GROUP 2 - JOB IDENTIFICATION (TITLE) AND COMMENTS.

\* REQUIRED INPUT FOR NSURF AND ISURF EXECUTION MODES \*

---

CARD 1                FORMAT(13A6,A2)     (TITLE(I),I=1,14)  
CARDS 2,3,4        FORMAT((13A6,A2)) (COMTS(I),I=1,42)     (JOB 1 ONLY)

#### GROUP 3 - VORTEX-LATTICE ANALYTICAL SOLUTION SPECIFICATIONS.

\* REQUIRED INPUT FOR NSURF AND ISURF EXECUTION MODES \*

---

\*\* NAMELIST INPUT FORMAT \*\*

```
NAMELIST/INPUT/ NFLG ,IFLG ,KOUT ,KT1 ,KT2 ,KT3 ,LINX
* ,NWIN ,NFUS ,NVTAIL,NSS ,X ,Y ,Z ,E ,C
* ,XOCR ,YSPAN ,NCS ,XOC ,ZOC ,WFLAP1,WFLAP2,WFLAP3,FLAPC
* ,TABC ,FLAPDJ,TABDJ ,AILDJ ,XCG ,YCG ,ZCG ,REFS ,REFC
* ,REFB ,GSCALE,NJOB ,ALFA ,MACHN ,HEIGHT,FLAPDJ,AILDJ ,NSOLV
* ,NJOB1 ,WCL ,CBLQCP,WSMOTH,LFLAP ,LDRAG ,CLEANF,PMECF ,CUTOF1
* ,CUTOF2
```

\*\* JOB-EXECUTION FLAGS \*\*

(1) NFLAG REQUIRED FOR NSURF EXECUTION MODE.

---

(NFLG(N),N=1,M)        NUMBER OF SPANWISE VORTEX-LATTICE ELEMENTS ASSIGNED  
                         TO THE N SURFACE, WHERE M.LE.5.



### 3.4 INPUT INSTRUCTIONS (CONTINUED)

(NFLG(N+5),N=1,M) NUMBER OF CHORDWISE VORTEX-LATTICE ELEMENTS ASSIGNED TO THE N SURFACE.

(NFLG(N+10),N=1,M) NUMBER OF CHORDWISE DISCONTINUITIES ASSIGNED TO THE N SURFACE, WHERE,  
NFLG(N+10).EQ.0 NO FLAPS AND/OR AILERONS,  
NFLG(N+10).GE.1 WITH FLAPS AND/OR AILERONS,  
NFLG(N+10).EQ.2 WITH TAB SURFACE.

NFLG(16) = 0 ZOC(K,J) INPUT IS DIMENSIONLESS (NORMALIZED BY C(J)),  
= 1 ZOC(K,J) INPUT IS DIMENSIONED USING THE SAME UNITS AS THE WING PLANFORM SPECIFICATIONS (E.G., Y(J),X(J),ETC.)

NFLG(17) = 0 NO EFFECT (OUT-OF-GROUND).  
= 1 GROUND EFFECTS, I.E., FLIGHT IN THE PRESENCE OF A GROUND PLANE ARE CALCULATED.

NFLG(18) = 0 NO EFFECT.  
= 1 ARRAYS OF SOLUTIONS USING LIFTING LINE THEORY ARE CALCULATED FROM A PAIR OF EXACT VORTEX-LATTICE SOLUTIONS, THIS OPTION NOT OPERATIONAL AT PRESENT.

NFLG(19) = 0 NO EFFECT.  
= 1 CALCOMP OR MICROFILM PLOT DATA TAPE IS GENERATED.

NFLG(20) = ND PRINT-OUTPUT CONTROL EFFICIENCY FLAG ASSIGNMENT, USED AS FOLLOWS,  
ND.GE.0 = SHORT-PRINT OUTPUT, I.E., NAMELIST \$INPUT, SURFACES GEOMETRY, AIRFOIL MEAN-CAMBER, AND, SECTION AND SPATIALLY-INTEGRATED AIRLOAD COEFFICIENTS ARE OUTPUT,  
ND.GE.1 = VORTEX-LATTICE GEOMETRY DETAIL IS OUTPUT.  
ND.GE.2 = VORTEX-LATTICE ELEMENTAL LIFT AND INDUCED VELOCITY ARE OUTPUT  
ND.GE.5 = VORTEX-LATTICE GEOMETRY DETAIL, AND INDUCED VELOCITY INCREMENTS ARE OUTPUT.  
ND.GE.8 = DEBUG OUTPUT FOR PROGRAM CHECK/DEVELOPMENT, I.E., NAMELISTS \$DEBUG1, \$DEBUG2, AND \$DEBUG3 ARE OUTPUT,  
ND.GT.15,AND,NFLG(17).GE.1 = DEBUG OUTPUT FOR PROGRAM CHECK/DEVELOPMENT, I.E., NAMELIST \$REFLEX IS OUTPUT.

#### (2) IFLAG REQUIRED FOR ISURF EXECUTION MODE.

IFLG(1) = 0 SYMMETRIC LIFT LOADING, NOT REQUIRED FOR INPUT, VALUES  
= 1 UNSYMMETRIC LIFT LOADING, ARE ASSIGNED IN EXECUTION

IFLG(2) = NSD NUMBER OF SPAN DISCONTINUITIES, NSD= 0,1,2,3,OR 4,  
REQUIRED INPUT IF IFLG(4).NE.0.

IFLG(3) = NSE NUMBER OF SPAN VORTEX-LATTICE ELEMENTS, NSE.LE.NSEMAX,  
WHERE NSEMAX=41 AND 21 FOR SYMMETRIC AND UNSYMMETRIC LIFT LOADING RESPECTIVELY.

IFLG(4) = 0 EQUAL SPAN-SPACING FOR VORTEX-LATTICE ELEMENTS.  
= 1 COSINE (VARIABLE) SPAN SPACING OF VORTEX-LATTICE ELEMENTS,  
= 2 SPAN-SPACING OF VORTEX-LATTICE ELEMENTS IS TO BE ASSIGNED IN THE INPUT, (YSPAN(N),N=1,NSE).

### 3.4 INPUT INSTRUCTIONS (CONTINUED)

IFLG(5) = NCD      NUMBER OF CHORD DISCONTINUITIES, WHERE NCD=0 AND NCD=1  
MUST BE ASSIGNED TO UNFLAPPED AND FLAPPED WING SURFACES  
RESPECTIVELY.

IFLG(6) = NCE      NUMBER OF CHORD VORTEX-LATTICE ELEMENTS, NCE,LE,NCMAX,  
WHERE NCEMAX=9, AND NCE,GE,2 FOR FLAPPED SURFACES.

IFLG(7) = 0      EQUAL CHORD-SPACING FOR VORTEX-LATTICE ELEMENTS,  
      = 1      COSINE (VARIABLE) CHORD SPACING OF VORTEX-LATTICE  
ELEMENTS.

IFLG(8) = 0      NO EFFECT.  
      = 1      ARRAYS OF SOLUTIONS USING LIFTING LINE THEORY ARE  
CALCULATED FROM A PAIR OF EXACT VORTEX-LATTICE  
SOLUTIONS.

IFLG(9) = 0      NO EFFECT.  
      = 1      GROUND EFFECTS, I.E., FLIGHT IN THE PRESENCE OF A GROUND  
PLANE ARE CALCULATED.

IFLG(10) = ND      PRINT-OUTPUT CONTROL EFFICIENCY FLAG ASSIGNMENT,  
USED AS FOLLOWS,

          ND.GE,0 = SHORT-PRINT OUTPUT, I.E., NAMELIST \$INPUT,  
                  SURFACES GEOMETRY, AIRFOIL MEAN-CAMBER, AND,  
                  SECTION AND SPATIALLY-INTEGRATED AIRLOAD  
                  COEFFICIENTS ARE OUTPUT,

          ND.GE,1 = VORTEX-LATTICE GEOMETRY DETAIL IS OUTPUT.

          ND.GE,2 = VORTEX-LATTICE ELEMENTAL LIFT AND INDUCED  
                  VELOCITY ARE OUTPUT

          ND.GE,5 = VORTEX-LATTICE GEOMETRY DETAIL, AND INDUCED  
                  VELOCITY INCREMENTS ARE OUTPUT.

          ND.GE,8 = DEBUG OUTPUT FOR PROGRAM CHECK/DEVELOPMENT,  
                  I.E., NAMELISTS \$DEBUG1, \$DEBUG2, AND \$DEBUG3  
                  ARE OUTPUT,

          ND.GT,15,AND,IFLG(9).GE,1 = DEBUG OUTPUT FOR PROGRAM  
                  CHECK/DEVELOPMENT, I.E., NAMELIST \$REFLEX  
                  IS OUTPUT.

IFLG(11)= 0      NO EFFECT.  
      = 1      OUTPUT SOLUTIONS FOR CHORDWISE AND SPANWISE SECTION  
AIRLOAD COEFFICIENTS,

IFLG(12)= 0      NO EFFECT,  
      = 1      OUTPUT SURFACE PLANFORM GEOMETRY ON CALCOMP/MICROFILM  
PLOT TAPE.

IFLG(13)= 0      NO EFFECT,  
      = 1      OUTPUT CHORD AND SPAN SECTION AIRLOAD COEFFICIENTS ON  
CALCOMP/MICROFILM PLOT TAPE,

IFLG(14)= 0      NO EFFECT,  
                  OUTPUT LINEARIZED SOLUTION OF AIRLOAD COEFFICIENTS ON  
CALCOMP/MICROFILM PLOT TAPE,

IFLG(15)      NOT A REQUIRED INPUT, VALUE ASSIGNED IN EXECUTION.

#### \*\* OUTPUT SPECIFICATIONS \*\*

KOUT      (=6 IF OMITTED) PRINT BCD OUTPUT PHYSICAL UNIT ASSIGNMENT,

KT1      (=1 IF OMITTED) SCRATCH/WORK PHYSICAL UNIT ASSIGNMENT.

### 3.4 INPUT INSTRUCTIONS (CONTINUED)

KT2        (=8, ASG LOGICAL UNIT F, IF OMITTED) CALCOMP/MICROFILM DRUM OR  
TAPE PHYSICAL UNIT ASSIGNMENT.

KT3        (=3 IF OMITTED) SCRATCH/WORK PHYSICAL UNIT ASSIGNMENT.

LINX       (=56 IF OMITTED) MAXIMUM NUMBER OF LINES PER PAGE FOR PRINTED  
OUTPUT.

\*\* SURFACE TYPE CLASSIFICATIONS \*\*  
\* OMIT FOR XQT ISURF EXECUTION MODE \*

NWING      (=1 IF OMITTED) NUMBER OF SYMMETRIC LIFTING SURFACES, E.G., WING  
SURFACES, THAT MUST BE ORDERED AS FOLLOWS,

N = 1,2,3,...,NWING,        (N.LE.5)

NFUS       (=0 IF OMITTED) NUMBER OF ANTISYMMETRIC LIFTING SURFACES, E.G.,  
VERTICAL SURFACE/S ASSIGNED TO REPRESENT A FUSELAGE OR A VERTICAL  
FIN, THAT MUST BE ORDERED AS FOLLOWS,

N = 1,2,3,...,NWING+NFUS,    (N.LE.5)

NVTAIL     (=0 IF OMITTED) NUMBER OF ANTISYMMETRIC LIFTING SURFACES, E.G.,  
VERTICAL SURFACE/S ASSIGNED TO REPRESENT A VERTICAL FIN, TWIN  
FINS, END PLATES, ETC., THAT MUST BE ORDERED AS FOLLOWS,

N = 1,2,3,...,NWING+NFUS+IABS(NVTAIL),    (N.LE.5)

NVTAIL MAY BE ENTERED AS A POSITIVE OR A NEGATIVE INTEGER IN  
ORDER TO SPECIFY SYMMETRY ABOUT THE PLANE Y=0, I.E.,

+ INTEGER = ANTISYMMETRIC SURFACE, E.G. A SINGLE FIN,  
- INTEGER = SYMMETRIC SURFACE, E.G. TWIN FINS,

NS         (NOT AN INPUT QUANTITY) TOTAL NUMBER OF SURFACES TO BE CONSIDERED  
THAT IS CALCULATED INTERNALLY USING THE FOLLOWING FORMULA

NS= NWING + NFUS + IABS(NVTAIL) (NS.LE.5)

N         (NOT AN INPUT QUANTITY) ORDER NUMBER ASSIGNED TO NTH.SURFACE.

\*\* SURFACE PLANFORM SPECIFICATIONS \*\*  
\* NS= 1 FOR XQT ISURF EXECUTION MODE \*

(NSS(N),N=1,NS)        STORAGE ORDER NUMBER ALLOCATED TO THE LAST SPAN  
STATION ENTRY FOR THE N LIFTING SURFACE, WHERE,

NSS(1)        = NUMBER OF SPAN STATION ENTRIES  
ALLOCATED TO THE FIRST SURFACE,

NSS(N)-NSS(M) = NUMBER OF SPAN STATION ENTRIES  
ALLOCATED TO THE N SURFACE, IN  
ORDER, N=1,2,...,M,N,...,NS.

(X(J),J=1,NSS(NS))    LONGITUDINAL COORDINATE OF JTH. POINT OF THE  
REFERENCE LOFT LINE, E.G., FUSELAGE STATIONS.

(Y(J),J=1,NSS(NS))    SPANWISE COORDINATE OF JTH. POINT OF THE REFERENCE  
LOFT LINE, E.G., WING STATIONS.

(Z(J),J=1,NSS(NS))    VERTICAL COORDINATE OF JTH. POINT OF THE REFERENCE  
LOFT LINE, E.G. WATERLINE STATIONS.

(E(J),J=1,NSS(NS))    ANGLE OF TWIST OF CHORD PLANE RELATIVE TO THE  
LONGITUDINAL COORDINATE FOR THE AIRFOIL SECTION  
AT THE JTH.POINT OF THE REFERENCE LOFT LINE,

### 3.4 INPUT INSTRUCTIONS (CONTINUED)

(C(J),J=1,NSS(NS)) CHORD LENGTH DIMENSION OF THE AIRFOIL SECTION AT THE JTH.POINT OF THE REFERENCE LOFT LINE.

(XPCR(J),J=1,NSS(NS)) (OMIT FOR XQT ISURF) THE RELATIVE LOCATION OF THE REFERENCE LOFT LINE IN CHORDS MEASURED FROM THE LEADING EDGE FOR THE JTH.POINT.

(XPCR(N),N=1) (OMIT FOR XQT NSURF) THE RELATIVE LOCATION OF THE REFERENCE LOFT LINE IN CHORDS MEASURED FROM THE LEADING EDGE ASSUMED CONSTANT FOR THE NTH.SURFACE,

(YSPAN(N),N=1,NSE+1) (REQUIRED IF(IFLG,GE,2) ) SPAN STATIONS THAT BOUND THE VORTEX MATRIX ELEMENTS.

**\*\* AIRFOIL SECTION (CAMBER) SPECIFICATIONS \*\***

(NCS(N),N=1,NS) NUMBER OF CHORD STATIONS ALLOCATED FOR DESCRIBING THE AIRFOIL SECTION MEAN CAMBER LINE FOR THE NTH, LIFTING SURFACE, WHERE,  
NCS(N).GE,2, AND/OR NCS(N).LE,10.

((XPC(K,N),K=1,NCS(N)),N=1,NS) CHORD STATION OF AIRFOIL SECTION, I.E., DISTANCE FROM THE LEADING EDGE MEASURED IN CHORDS ALONG THE AIRFOIL SECTION CHORD PLANE.

((ZPC(K,J),K=1,NCS(N)), J=1,NSS(NS),AND, N=1,NS) AIRFOIL SECTION MEAN CAMBER SPECIFICATION, I.E., NORMAL DISTANCE TO THE MEAN CAMBER LINE MEASURED IN CHORDS FROM THE AIRFOIL SECTION CHORD PLANE, CORRESPONDING TO THE JTH. POINT OF THE REFERENCE LOFT LINE.

**\*\* CONTROL SURFACE GEOMETRY SPECIFICATIONS \*\***

(WFLAP1(N),N=1,NS) SPAN DISTANCE FROM PLANE OF SYMMETRY TO THE INNER BOUNDARY OF THE FLAP SURFACE/S, WHERE,  
IF(WFLAP1(N).EQ,0,0) FLAP SURFACE IS CONTINUOUS AT THE CENTER SPAN SECTION,  
IF(WFLAP1(N).LE,1,0) DISTANCE MEASURED IN SPANS,

(WFLAP2(N),N=1,NS) SPAN DISTANCE FROM PLANE OF SYMMETRY TO THE OUTER BOUNDARY OF THE FLAP OR THE INNER BOUNDARY OF THE AILERON SURFACES, WHERE,  
IF(WFLAP2(N).LE,1,0) DISTANCE MEASURED IN SPANS,

(WFLAP3(N),N=1,NS) SPAN DISTANCE FROM PLANE OF SYMMETRY TO THE OUTER BOUNDARY OF THE AILERON SURFACES, WHERE,  
IF(WFLAP3(N).LE,1,0) DISTANCE MEASURED IN SPANS,

(FLAPC(J),J=1,NSS(NS)) (OMIT FOR XQT ISURF) FLAP/S AND/OR AILERONS CHORD LENGTH FOR THE JTH.POINT OF THE REFERENCE LOFT LINE, WHERE,  
IF(FLAPC(J).LT,1,0) FLAPC(J) IS NORMALIZED BY C(J),

(FLAPC(N),N=1,NS) (OMIT FOR XQT NSURF) FLAP/S AND/OR AILERONS CHORD LENGTH FOR THE NTH.SURFACE, WHERE,  
IF(FLAPC(N).LT,1,0) FLAPC(N) IS NORMALIZED BY C(J),

(TABC(J),J=1,NSS(NS)) (OMIT FOR XQT ISURF) TAB OR AUXILIARY ELEVONS CHORD LENGTH FOR THE JTH.POINT OF THE REFERENCE LOFT LINE, WHERE,

### 3.4 INPUT INSTRUCTIONS (CONTINUED)

IF(TABC(J).LT.1) TABC(J) IS NORMALIZED BY C(J).  
 (TABC(N),N=1,NS) (OMIT FOR XQT NSURF) TAB OR AUXILIARY ELEVONS CHORD LENGTH FOR THE NTH SURFACE, WHERE,  
 IF(TABC(N).LT.1) TABC(N) IS NORMALIZED BY C(J).  
 (FLAPDJ(N),N=1,NS) (OMIT FOR XQT ISURF) FLAP DEFLECTION (DEGREES), WHERE,  
 IF(FLAPDJ(N).GT.0) FLAP DEFLECTION IS DOWN,  
 IF(FLAPDJ(N).LT.0) FLAP DEFLECTION IS UP.  
 (TABDJ(N),N=1,NS) (OMIT FOR XQT ISURF) TAB DEFLECTION (DEGREES), WHERE,  
 IF(TABDJ(N).GT.0) TAB DEFLECTION IS DOWN,  
 IF(TABDJ(N).LT.0) TAB DEFLECTION IS UP.  
 ((AILDJ(L,N),L=1,2), N=1,NS) (OMIT FOR XQT ISURF) AILERON DEFLECTIONS (DEGREES), WHERE, L=1 DENOTES LEFT AILERON AND L=2 DENOTES RIGHT AILERON, AND,  
 IF(AILDJ(L,N).GT.0) AILERON DEFLECTION IS DOWN,  
 IF(AILDJ(L,N).LT.0) AILERON DEFLECTION IS UP,  
 IF(AILDJ(1,N).NE.AILDJ(2,N)) ANTISYMMETRIC LIFT,

#### \*\* REFERENCE DIMENSIONS \*\*

\* OMIT FOR XQT ISURF EXECUTION MODE \*

XCG (=0.0 IF OMITTED) LONGITUDINAL LOCATION OF THE CENTER OF GRAVITY MEASURED FROM THE LOFT COORDINATE SYSTEM ORIGIN.  
 YCG (=0.0 IF OMITTED) SPANWISE LOCATION OF THE CENTER OF GRAVITY MEASURED FROM THE LOFT COORDINATE SYSTEM ORIGIN.  
 ZCG (=0.0 IF OMITTED) VERTICAL LOCATION OF THE CENTER OF GRAVITY MEASURED FROM THE LOFT COORDINATE SYSTEM ORIGIN.  
 REFS (=1000.0 IF OMITTED) REFERENCE AREA FOR NORMALIZING THE CENTER AERODYNAMIC FORCE AND MOMENT COEFFICIENTS.  
 REFC (=100.0 IF OMITTED) REFERENCE CHORD FOR NORMALIZING THE CENTER AERODYNAMIC FORCE AND MOMENT COEFFICIENTS.  
 REFB (=100.0 IF OMITTED) REFERENCE SPAN FOR NORMALIZING THE CENTER AERODYNAMIC FORCE AND MOMENT COEFFICIENTS.  
 GSCALE (=1.0 IF OMITTED) GEOMETRY SCALING FACTOR THAT IS USED AS FOLLOWS, ALL DIMENSIONAL PHYSICAL QUANTITIES ARE MULTIPLIED BY GSCALE BEFORE EXECUTION, WITH THE EXCEPTION OF HEIGHT(N), THUS CHANGING THE SCALE OF THE INPUT GEOMETRY TO ANY DESIRED UNITS, AND, GSCALE IS SET EQUAL TO UNITY BEFORE THE NEXT JOB-RUN.

#### \*\* FLIGHT ATTITUDE AND MULTIPLE-SURFACE SOLUTION SPECIFICATIONS \*\*

NJOB NUMBER OF SEPARATE FLIGHT CONDITIONS OR JOB RUNS TO BE CALCULATED.  
 (ALFA(N),N=1,NJOB) FLIGHT ATTITUDE ANGLE OF ATTACK (DEG.), I.E., ANGLE BETWEEN FREE STREAM VELOCITY VECTOR AND THE LOFT COORDINATE SYSTEM LONGITUDINAL AXIS (X=AXIS).  
 (MACHN(N),N=1,NJOB) FLIGHT MACH NUMBER BASED ON FREE STREAM SPEED OF SOUND.  
 (HEIGHT(N),N=1,NJOB) ALTITUDE MEASURED FROM THE GROUND PLANE TO THE VEHICLE LOFT COORDINATE SYSTEM ORIGIN (X=Y=Z=0).

### 3.4 INPUT INSTRUCTIONS (CONTINUED)

(FLAPDJ(N),N=1,NJOB) (OMIT FOR XGT NSURF) FLAP DEFLECTION (DEGREES), WHERE,  
 IF(FLAPDJ(N).GT.0) FLAP DEFLECTION IS DOWN,  
 IF(FLAPDJ(N).LT.0) FLAP DEFLECTION IS UP,

((AILDJ(L,N),L=1,2), (OMIT FOR XGT NSURF) AILERON DEFLECTIONS (DEGREES),  
 N=1,NJOB) WHERE, L=1 DENOTES LEFT AILERON AND L=2 DENOTES  
 RIGHT AILERON, AND,  
 IF(AILDJ(L,N).GT.0) AILERON DEFLECTION IS DOWN,  
 IF(AILDJ(L,N).LT.0) AILERON DEFLECTION IS UP,  
 IF(AILDJ(1,N).NE.AILDJ(2,N)) ANTISYMMETRIC LIFT,

((NSOLV(M,N),M=1,2) (OMIT FOR XGT NSURF) MULTIPLE SURFACE SOLUTION  
 N=1,...5) SPECIFICATION FLAG, TO BE USED AS ILLUSTRATED IN  
 THE FOLLOWING EXAMPLE,

NSOLV= 1,1, 2,2, 1,2, 1,3, 2\*0,

MULTIPLE-SURFACE INDEPENDENT SOLUTIONS ARE OBTAINED  
 FOR THE FOLLOWING COMBINATIONS,

SURFACE 1 TO SURFACE 1 = SURFACE 1 ONLY,  
 SURFACE 2 TO SURFACE 2 = SURFACE 2 ONLY,  
 SURFACE 1 TO SURFACE 2 = SURFACES 1 AND 2 ONLY  
 SURFACE 1 TO SURFACE 3 = SURFACES 1 THROUGH 3,

\*\* LINEARIZED THEORY LIFTING-LINE SOLUTIONS OPTION \*\*

\* OMIT FOR XGT NSURF EXECUTION OPTION \*

NJOBBL (=0 IF OMITTED) NUMBER OF LINEARIZED LIFTING LINE  
 SOLUTIONS TO BE EXECUTED.

WCL(1) = 0 OR 1 (REQUIRED INPUT IF IFLG(8).GE.1) LINEARIZED SOLUTION  
 SPECIFICATION THAT IS USED AS FOLLOWS,

IF(WCL(1).EQ.0) ALFA(J),J=1,NJOBBL ARRAY CALCULATED,  
 IF(WCL(1).EQ.1) WCL(J+1),J=1,NJOBBL ARRAY CALCULATED

(WCL(J+1),J=1,NJOBBL) (REQUIRED INPUT IF(IFLG(8).GE.1,AND,WCL(1).GE.1)  
 WING LIFT COEFFICIENT

\*\* OPTIONAL-INPUT EXECUTION CONSTANTS \*\*

COLLOC (=0.75 IF OMITTED) COLOCATION POINT OR CONTROL POINT LOCATION  
 SPECIFICATION FOR THE VORTEX LATTICE ELEMENTS, A RANGE OF  
 0.75-0.83 IS GENERALLY USED.

WSMOTH (=0.10 IF OMITTED) FLAP AND/OR AILERON DISCONTINUITY COSINE-  
 SMOOTHING OPTION, WHERE,

IF(WSMOTH.LT.1,0) WSMOTH INPUT IN SPAN UNITS,  
 IF(WSMOTH.GT.1,0) WSMOTH INPUT IN PHYSICAL UNITS,

LFLAP (=0 IF OMITTED) FLAPPED SURFACE BOUNDARY CONDITIONS FLAG, USED  
 AS FOLLOWS,

IF(LFLAP.EQ.0) EXACT GEOMETRY OF FLAP OR AILERON IS USED IN  
 EVALUATING BOUNDARY CONDITIONS,

IF(LFLAP.EQ.1) LINEARIZED-FIRST ORDER THEORY IS USED IN  
 EVALUATING BOUNDARY CONDITIONS FOR THE FLAP  
 OR AILERON SURFACES,

### 3.4 INPUT INSTRUCTIONS (CONTINUED)

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LDRAG      (=0 IF OMITTED) CALCULATION OF INDUCED DRAG FLAG, USED AS FOLLOWS,
           IF(LDRAG.EQ.0) VORTEX LATTICE SOLUTION IS OUTPUT,
           IF(LDRAG.EQ.1) LIFTING-LINE THEORY IS USED IN CALCULATING
                        THE INDUCED DRAG (XQT ISURF ONLY),

CLEANF     (=0.0035 IF OMITTED) SURFACE SKIN FRICTION AERODYNAMIC CLEANNES
           FACTOR (= SF/AW) USED FOR XQT ISURF EXECUTION MODE ONLY,

PMECF      (=1.0 IF OMITTED) PITCHING MOMENT EMPIRICAL CORRECTION FACTOR
           USED FOR XQT ISURF EXECUTION MODE, IF(PMECF.EQ.1), THEORETICAL
           SOLUTION IS OUTPUT,

CUTØF1     (=0.0001 IF OMITTED) CUTOFF LIMIT FOR RADIUS TO A VORTEX FILAMENT
           ELEMENT FROM A FLOW-FIELD POINT NORMALIZED BY THE VORTEX FILAMENT
           SPAN,

CUTØF2     (=0.0029 IF OMITTED) CUTOFF LIMIT FOR ANGLE (RADIAN) MEASURED
           BETWEEN A VORTEX FILAMENT AND A FLOW-FIELD POINT RELATIVE TO THE
           ORIGIN OF THE VORTEX LOCAL COORDINATE SYSTEM,

DELALF     (=1.0 IF OMITTED) ANGLE OF ATTACK INCREMENT BETWEEN THE TWO EXACT
           VORTEX-LATTICE SOLUTIONS THAT ARE GENERATED FOR DETERMINING THE
           LINEARIZED (LIFTING LINE) THEORY ARRAYS OF SOLUTIONS.

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**GROUP 4 - JOB/JOBS TERMINATION CARD**

\* REQUIRED INPUT FOR NSURF AND ISURF EXECUTION MODES \*

CARD 1            FORMAT(9H \$ENDJØBS) MUST HAVE \$ENDJOBS IN COLUMNS 2-9  
                       (COLUMN 1 FIELD MUST BE LEFT BLANK)

NOTE: INPUT INSTRUCTIONS FOR THE CALCOMP/4060-MICROFILM PLOT-OUTPUT OPTION, XQT TRWPLT, ARE FOUND IN REFERENCE 35. THESE INSTRUCTIONS HAVE BEEN OMITTED IN THE PRESENT REPORT.

### 3.5 ALPHABETICAL LIST OF INPUT QUANTITIES

VARIABLE	DIMENSION	UNITS	RESTRICTION	CLASS	DESCRIPTION AND/OR FUNCTION
AILDJ	REAL(2,5) REAL(2,10)	DEG. DEG.	NSURF ONLY ISURF ONLY	FLAP/AIL, FLAP/AIL.	AILERON-SURFACES DEFLECTION, AILERON-SURFACES DEFLECTION.
ALFA	REAL(10) REAL(20)	DEG. DEG.	NSURF ONLY ISURF ONLY	ATTITUDE ATTITUDE	ANGLE OF ATTACK, ANGLE OF ATTACK,
AW	REAL	L**2	ISURF ONLY	OPT.CONST.	WETTED AREA,
C	REAL(30) REAL(10)	L L	NSURF ONLY ISURF ONLY	SURF.PLAN SURF.PLAN	CHORD LENGTH, CHORD LENGTH,
CLEANF	REAL	NONE	ISURF ONLY	OPT.CONST.	AERODYNAMIC CLEANNESS FACTOR,
CØLØCP	REAL	NONE	NONE	OPT.CONST.	COLOCATION OR CONTROL POINT,
CUTØF1	REAL	L/R	NONE	OPT.CONST.	CUTOFF LIMIT FOR RADIUS VECTOR,
CUTØF2	REAL	RADIAN	NONE	OPT.CONST.	CUTOFF LIMIT FOR SMALL ANGLES,
DELALF	REAL	DEG.	ISURF ONLY	OPT.CONST.	ANGLE OF ATTACK INCREMENT FOR LINEARIZED THEORY.
E	REAL(30) REAL(10)	DEG. DEG.	NSURF ONLY ISURF ONLY	SURF.PLAN SURF.PLAN	CHORD PLANE GEOMETRIC TWIST, CHORD PLANE GEOMETRIC TWIST.
FLAPDJ	REAL(5) REAL(10)	DEG. DEG.	NSURF ONLY ISURF ONLY	FLAP/AIL, FLAP/AIL.	FLAP-SURFACE DEFLECTION, FLAP-SURFACE DEFLECTION,
FLAPC	REAL(30) REAL	L L	NSURF ONLY ISURF ONLY	FLAP/AIL, FLAP/AIL.	FLAP/AILERON CHORD LENGTH, FLAP/AILERON CHORD LENGTH.
GSCALE	REAL	NONE	NSURF ONLY	REF.DIM.	GEOMETRIC SCALING FACTOR,
HEIGHT	REAL(10)	L	NONE	ATTITUDE	ALTITUDE FROM GROUND PLANE,
IFLG	INTG(15)	NONE	ISURF ONLY	FLAG	JOB EXECUTION FLAG FOR ISURF.
KØUT	INTEGER	NONE	NONE	OUTPUT	BCD PRINT-OUTPUT UNIT ASSIG.
KT1	INTEGER	NONE	NONE	OUTPUT	SCRATCH/WORK BCD UNIT ASSIG.
KT2	INTEGER	NONE	NONE	OUTPUT	CALCOMP/FILM BCD UNIT ASSIG.
KT3	INTEGER	NONE	NONE	OUTPUT	SCRATCH/WORK BCD UNIT ASSIG.
L	REAL	L	NONE	NONE	LINEAR DIMENSION, E.G., FEET, INCHES,METERS,ETC.
LDRAG	REAL	NONE	ISURF ONLY	OPT.CONST.	INDUCED DRAG FACTOR,
LFLAP	REAL	NONE	NONE	OPT.CONST.	LINEAR THEORY FACTOR FOR FLAP.
LINX	INTEGER	NONE	NONE	OUTPUT	MAX.NO.LINES PER PRINTED PAGE.
MACHN	REAL(10)	NONE	NONE	ATTITUDE	FLIGHT FREE-STREAM MACH NUMBER.
NCS	INTG(5)	NONE	NONE	AIRFOIL	NO.OF CHORD STATIONS.
NFLG	INTG(20)	NONE	NSURF ONLY	FLAG	JOB EXECUTION FLAG FOR NSURF.
NFUS	INTEGER	NONE	NSURF ONLY	SURF.TYPE	NO,SYMMETRIC FUS. SURFACES,
NJØB	INTEGER	NONE	NONE	ATTITUDE	NO,OF FLIGHT ATTITUDES,



### 3.5 ALPHABETICAL LIST OF INPUT QUANTITIES (CONTINUED)

VARIABLE	DIMENSION	UNITS	RESTRICTION	CLASS	DESCRIPTION AND/OR FUNCTION
NJOBL	INTEGER	NONE	ISURF ONLY	LINEAR OPT	NO. OF SEPARATE FLIGHT ATTITUDES FOR LIFTING-LINE SOLUTIONS,
NSOLV	INTG(12)	NONE	NSURF ONLY	ATTITUDE	MULTIPLE-SURFACE SOLUTION FLAG,
NSS	INTG(5)	NONE	NONE	SURF,PLAN	STORAGE ALLOCATION-ORDER INDEX,
NVTAIL	INTEGER	NONE	NSURF ONLY	SURF,TYPE	NO,VERT,ANTISYMM, SURFACES,
NWING	INTEGER	NONE	NSURF ONLY	SURF,TYPE	NO,SYMMETRIC WING SURFACES,
PMECF	REAL	NONE	ISURF ONLY	OPT,CONS.	PITCHING MOMENT FACTOR,
REFB	REAL	L	NSURF ONLY	REF.DIM.	REFERENCE SPAN LENGTH,
REFC	REAL	L	NSURF ONLY	REF.DIM.	REFERENCE CHORD LENGTH,
REFS	REAL	L**2	NSURF ONLY	REF.DIM.	REFERENCE AREA,
SF	REAL	L**2	ISURF ONLY	OPT,CONS	EQUIVALENT FLAT PLATE AREA,
TABC	REAL(30)	L	NSURF ONLY	FLAP/AIL.	TAB CHORD LENGTH,
TABDJ	REAL(5)	DEG.	NSURF ONLY	FLAP/AIL.	TAB-SURFACE DEFLECTION,
WCL	REAL(21)	NONE	ISURF ONLY	LINEAR OPT	WING LIFT COEFFICIENT FOR LIFTING LINE SOLUTIONS,
WFLAP1	REAL(5)	L	NONE	FLAP/AIL.	FLAP SPAN INNER-EDGE DIM,
WFLAP2	REAL(5)	L	NONE	FLAP/AIL.	AILERON SPAN INNER-EDGE DIM,
WFLAP3	REAL(5)	L	NONE	FLAP/AIL.	AILERON SPAN OUTER-EDGE DIM,
WSMOOTH	REAL	L	NONE	OPT,CONS.	COSINE SMOOTHING SCALE,
XCG	REAL	L	NSURF ONLY	REF.DIM.	LONGITUDINAL LOCATION OF C,G.
X	REAL(30) REAL(10)	L L	NSURF ONLY ISURF ONLY	SURF,PLAN SURF,PLAN	REF.LOFT LINE X-COORDINATE, REF.LOFT LINE X-COORDINATE,
XOC	REAL(10,5) REAL(10)	L/C L/C	NSURF ONLY ISURF ONLY	AIRFOIL AIRFOIL	CHORD STATION FOR AIRFOIL SECT, CHORD STATION FOR AIRFOIL SECT,
XOCR	REAL(30) REAL	L/C L/C	NSURF ONLY NSURF ONLY	SURF,PLAN SURF,PLAN	RELATIVE LOCATION OF REF.LOFT LINE, RELATIVE LOCATION OF REF.LOFT LINE,
Y	REAL(30) REAL(10)	L L	NSURF ONLY ISURF ONLY	SURF,PLAN SURF,PLAN	REF.LOFT LINE Y-COORDINATE, REF.LOFT LINE Y-COORDINATE,
YCG	REAL	L	NSURF ONLY	REF.DIM.	SPANWISE LOCATION OF C,G.
YSPAN	REAL(42)	L	ISURF ONLY	SURF,PLAN	SPAN STATIONS THAT BOUND VORTEX LATTICE ELEMENTS,
Z	REAL(30) REAL(10)	L L	NSURF ONLY ISURF ONLY	SURF,PLAN SURF,PLAN	REF.LOFT LINE Z-COORDINATE, REF.LOFT LINE Z-COORDINATE,
ZCG	REAL	L	NSURF ONLY	REF.DIM.	VERTICAL LOCATION OF C,G.
ZOC	REAL(10,30) REAL(10,10)	L/C L/C	NSURF ONLY ISURF ONLY	AIRFOIL AIRFOIL	MEAN CAMBER FOR AIRFOIL SECT, MEAN CAMBER FOR AIRFOIL SECT,

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### 3.6 LIST OF ABBREVIATIONS FOR INPUT

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AIL	AILERON
ASSIG.	ASSIGNMENT
CONS.	CONSTANT
C.G.	CENTER OF GRAVITY
DEG.	DEGREES, ANGULAR MEASURE
DIM.	DIMENSION
.EQ.	EQUAL
E.G.	FOR EXAMPLE
.GE.	GREATER OR EQUAL
.GT.	GREATER THAN
IABS	ABSOLUTE VALUE OF AN INTEGER CONSTANT
INTG	INTEGER
I.E.	EQUIVALENT TO
.LE.	LESS OR EQUAL
.LT.	LESS THAN
OPT.	OPTIONAL
REF	REFERENCE
SURF.	SURFACE
*	MULTIPLICATION
**	EXPONENTIATION

# 1.0 PROGRAM DATA TABLES

TABLE 4.01 - INITIAL VALUES

VARIABLE	DIMENSION	RESTRICTION	INITIAL VALUE/S
AILDJ	REAL(2,5) REAL(2,10)	NSURF ONLY ISURF ONLY	10*0.0, 20*0.0,
ALFA	REAL(10) REAL(20)	NSURF ONLY ISURF ONLY	10*0.0, 20*0.0,
C	REAL(30) REAL(10)	NSURF ONLY ISURF ONLY	2*100.0,28*0.0, 10*100.0,
CLEANF	REAL	ISURF ONLY	0.0035,
CØLØCP	REAL	NONE	0.75,
CUTØF1	REAL	NONE	0.0001,
CUTØF2	REAL	NONE	0.0029,
DELALF	REAL	ISURF ONLY	1.0,
E	REAL(30) REAL(10)	NSURF ONLY ISURF ONLY	30*0.0, 10*0.0,
FLAPDJ	REAL(5) REAL(10)	NSURF ONLY ISURF ONLY	5*0.0, 10*0.0,
FLAPC	REAL(30) REAL	NSURF ONLY ISURF ONLY	30*0.25, 0.3,
GSCALE	REAL	NSURF ONLY	1.0,
HEIGHT	REAL(10)	NONE	10*1.0E+5,
IFLG	INTG(15)	ISURF ONLY	0,0,10,0,0,1,0,0,0,1,0,0,0,0,0,
KØUT	INTEGER	NONE	6,
KT1	INTEGER	NONE	1,
KT2	INTEGER	NONE	8,
KT3	INTEGER	NONE	3,
LDRAG	INTEGER	ISURF ONLY	0,
LFLAP	INTEGER	NONE	0,
LINX	INTEGER	NONE	56,
NIACHN	REAL(10)	NONE	10*0.0,
NICS	INTG(5) INTEGER	NSURF ONLY ISURF ONLY	2,4*0, 2,

TABLE 4.01 - INITIAL VALUES (CONTINUED)

VARIABLE	DIMENSION	RESTRICTION	INITIAL VALUE/S
NFLG	INTG(20)	NSURF ONLY	10,0,0,0,0,4,0,0,0,0,0,0,0,0,0,0,0,0,0,4,
NFUS	INTEGER	NSURF ONLY	0,
NJOB	INTEGER	NONE	1,
NJOB1	INTEGER	ISURF ONLY	20,
NSOLV	INTG(12)	NSURF ONLY	1,1,10*0,
NSS	INTG(5) INTEGER	NSURF ONLY ISURF ONLY	2,4*0, 2,
NVAIL	INTEGER	NSURF ONLY	0,
NWING	INTEGER	NSURF ONLY	1,
PMECF	REAL	ISURF ONLY	1,0,
REFB	REAL	NSURF ONLY	100,0,
REFC	REAL	NSURF ONLY	100,0,
REFS	REAL	NSURF ONLY	1000,0,
TABC	REAL(30)	NSURF ONLY	30*0,125,
TABDJ	REAL(5)	NSURF ONLY	5*0,0,
WCL	REAL(21)	ISURF ONLY	+1,0,-0,4,-0,3,-0,2,-0,1,+0,0,+0,1, +0,2,+0,3,+0,4,+0,5,+0,6,+0,7,+0,8, +0,9,+1,0,+1,1,+1,2,+1,3,+1,4,+1,5,
WFLAP1	REAL(5) REAL	NSURF ONLY ISURF ONLY	5*0,0, 0,0,
WFLAP2	REAL(5) REAL	NSURF ONLY ISURF ONLY	5*0,6, 0,6,
WFLAP3	REAL(5) REAL	NSURF ONLY ISURF ONLY	5*1,0, 1,0,
WSMOTH	REAL REAL	NSURF ONLY ISURF ONLY	0,1, 0,2,
XCG	REAL	NSURF ONLY	0,0,
X	REAL(30) REAL(10)	NSURF ONLY ISURF ONLY	30*0,0, 10*0,0,
XDC	REAL(10,5) REAL(10)	NSURF ONLY ISURF ONLY	0,0,1,0,48*0,0, 0,0,1,0,8*0,0,

TABLE 4.01 - INITIAL VALUES (CONTINUED)

[illegible]

## 5.0 OUTPUT

### 5.1 General Description of Output

The printed-output and tape-output for the main execution modes of the program are organized in the following manner.

#### 1) Raw Data

The input data for all the case studies that are to be executed by the computer which includes punched card data up to and including the \$ENDJØBS card is printed in the first page or pages in the exact form it was read into the computer, i.e., raw data including punched-card errors, etc.

#### 2) Initial Values

For each individual case study to be executed the job-execution flags, geometry data, flight data, etc. are output via NAMELIST statement, i.e., the values of all the input variables are output via \$INPUT.

#### 2) Short-Print Output (NFLG(20) or IFLG(10) = 0)

The following tables are output under the short-print output option:

<u>Table Title &amp; Description</u>	<u>Table # in Section 5.2</u>
Lifting-Surface Geometry (one for each surface)	Table 5.01
Camber for Airfoil Section (one for each surface)	Table 5.02
Section Airload Coefficients (one for each surface)	Table 5.03
Spatially-Integrated Airload Coefficients	Table 5.04
Linearized (Lifting-Line) Solutions (ISURF execution mode only)	Table 5.05
Job/Jobs Termination Output	Table 5.06

#### 4) Long-Print Output (NFLG(20) or IFLG(10) ≥ 2)

The short-print tables and the following tables are output under the long-print option:

<u>Table Title &amp; Description</u>	<u>Table # in Section 5.2</u>
Vortex-Lattice Geometry Detail (one for each surface)	Table 5.07
Lift Distribution Detail (one for each surface)	Table 5.08

## 5.1 General Description of Output (Continued)

### 5) Debug-Print Output (NFLG(20) or IFLG(10) $\geq$ 5)

In addition to the short-print and long-print tables, the following tables are output under the debug-print option

<u>Table Title &amp; Description</u>	<u>Table # in Section 5.2</u>
Vortex-Lattice Induced Velocity Matrices Detail (one for each surface)	Table 5.09

### 6) Program Checkout-Print Output (NFLG(20) or IFLG(10) $\geq$ 16)

Under the program checkout-print option, detail data on the vortex-lattice velocity induced for each individual vortex filament is output via NAMELIST statement, accordingly

<u>Table Title &amp; Description</u>	<u>Table # in Section 5.2</u>
Program Checkout & Debug Print	Table 5.10

### 7) Tape Output (NFLG(19) or IFLG (11) through IFLG(14) $>$ 1)

A summary of the analytical solutions generated by the program is output on magnetic tape. This output is used by the auxiliary execution mode (TRWPLT) for generating 4060-microfilm or Calcomp output. A detailed description of the format and variables output on tape is presented in Section 5.3.

### 8) Execution Diagnostics and Job Abort Output

See Section 5.4.

### 9) Alphabetical List of Output Quantities

See Section 5.5.

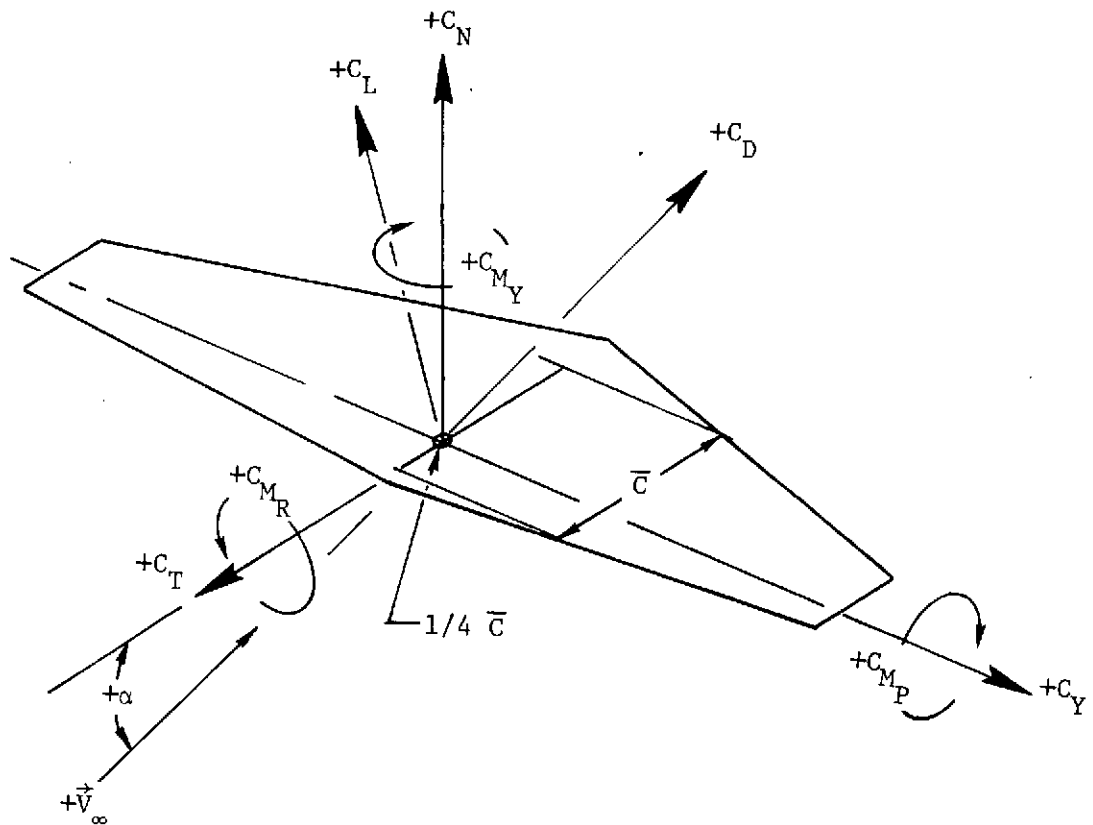
### 10) List of Abbreviations for Output

See Section 5.6.

### 11) Sign Conventions for Output

The sign conventions adopted for output purposes are described in Figure 5.01 (Page 5-3).

A) AIRLOAD AND MOMENT COEFFICIENTS



B) LIFTING-SURFACE GEOMETRY

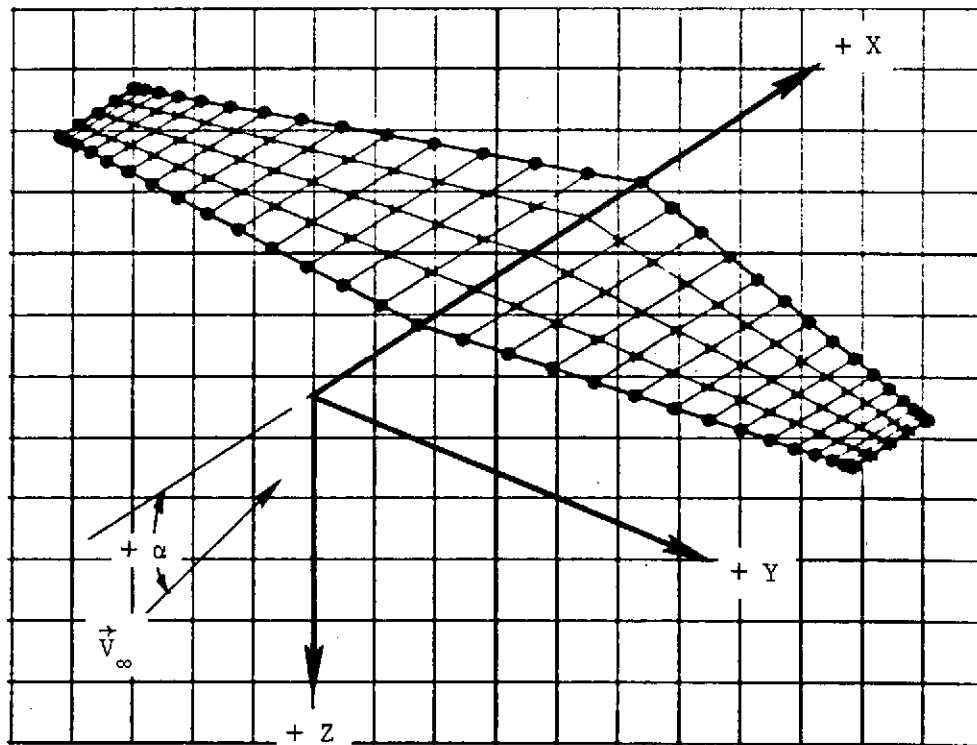


FIGURE 5.01 - LIFTING-SURFACE SOLUTIONS SIGN CONVENTIONS FOR OUTPUT



## 5.2 Printed-Output Format Summary

### 1) Short-Print Output

TABLE 5.01 - LIFTING-SURFACE GEOMETRY (One for Each Surface)

LIFTING SURFACE NC= N <sub>j</sub>											
*****											
SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
b	C <sub>R</sub>	C <sub>T</sub>	ε <sub>R</sub>	ε <sub>T</sub>	S	AR	C <sub>mean</sub>	$\bar{C}$	$\bar{Y}$	$\bar{X}$	$\bar{Z}$
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	CHORD. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
Y <sub>1</sub>	Y <sub>2</sub>	Y <sub>3</sub>	δ <sub>f</sub>	δ <sub>tab</sub>	δ <sub>LA</sub>	δ <sub>RA</sub>	φ( $\bar{C}/4$ )	Λ( $\bar{C}/4$ )	NSE	NCE	NCD
			FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	ARFA S(CG)	CHORD C(CG)	SPAN B(CG)			
			X <sub>ref</sub>	Y <sub>ref</sub>	Z <sub>ref</sub>	S <sub>ref</sub>	$\bar{C}_{ref}$	b <sub>ref</sub>			
WS	Y	Z	X(LF)	X(C/4)	X(TE)	TWIST	D(HF(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
W	Y	Z	X <sub>LE</sub>	X( $\bar{C}/4$ )	X <sub>TE</sub>	ε	φ(C/4)	Λ(C/4)	C	C <sub>f</sub>	C <sub>tab</sub>
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

5-4

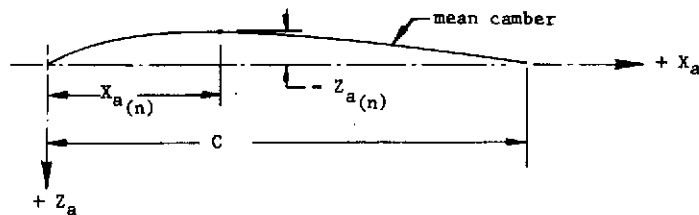
ORIGINAL PAGE IS  
OF POOR QUALITY

## 5.2 Printed-Output Format Summary (Continued)

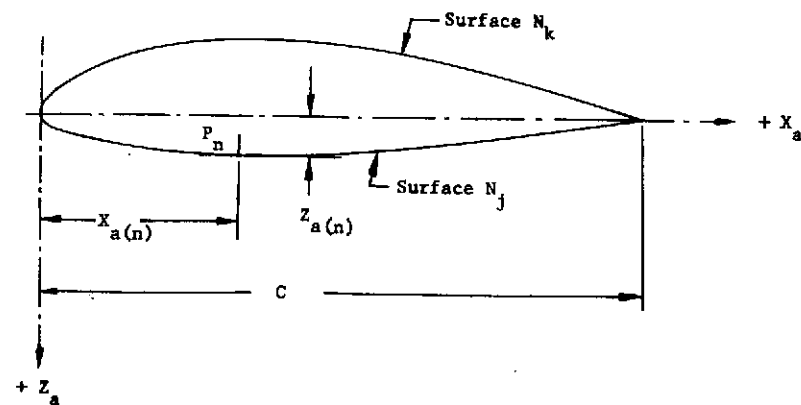
TABLE 5.02 - AIRFOIL-SECTION CAMBER (One for Each Surface)

		XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

[A] Single-Surface Representation



[B] Two-Surface Representation



## 5.2 Printed-Output Format Summary (Continued)

TABLE 5.03 - SECTION AIRLOAD COEFFICIENTS (One for Each Surface)

### [A] NSURF Execution Mode

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.=  $N_1/(N_1, N_k)$   
\*\*\*\*\*

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	IXL	IYL	IZL
j	Y/b	Y	Z	W	$c_n$	$c_x$	$c_l$	$c_d$	$c_m(C/4)$	$c_l C/b$	section	airloads	unit vector
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

### [B] ISURF Execution Mode

SECTION LIFT COEFFICIENTS  
\*\*\*\*\*

J	ZY/R	Y	C	SCL	SCLC/B	DLIFT	SCMIC/4)	IXL	IYL	IZL
j	Y/(b/2)	Y	C	$c_l$	$c_l C/b$	$\Delta L/q_\infty$	$c_m(C/4)$	airload	unit	vector
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

## 5.2 Printed-Output Format Summary (Continued)

TABLE 5.03 [B] - SECTION AIRLOAD COEFFICIENTS (Continued)

CHORDWISE PRESSURE DISTRIBUTION DETAIL											
*****											
***** CHORD STATION (X-XLE)/C *****											
(X - X <sub>LE</sub> )/C	.00000	.10000	.20000	.30000	.40000	.50000	.60000	.70000	.80000	.90000	1.00000
2Y/B	SCL	***** CHORD PRESSURE (CPL - CPU)*17L *****									
Y/(b/2)	c <sub>l</sub>	(c <sub>pL</sub> - c <sub>pU</sub> )									
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

SPANWISE SECTION LIFT DISTRIBUTION DETAIL										
*****										
WITH LE SUCTION				NO LE SUCTION			FLAP/AILERON			
Y	2Y/B	SCL	SCDI	SCM(C/4)	SCL	SCDI	SCM(C/4)	FCN	FCX	FCM
Y	Y/(b/2)	c <sub>l</sub>	c <sub>d1</sub>	c <sub>m(C/4)</sub>	c <sub>lv</sub>	c <sub>d1,v</sub>	c <sub>m(C/4)</sub>	c <sub>nf</sub>	c <sub>xf</sub>	c <sub>hf</sub>
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

## 5.2 Printed-Output Format Summary (Continued)

TABLE 5.04 - SPATIALLY-INTEGRATED AIRLOAD COEFFICIENTS

### [A] NSURF Execution Mode

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS. =  $N_1 - N_k$   
\*\*\*\*\*

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
$N_j$	$C_N$	$C_X$	$C_Y$	$C_L$	$C_{D_i}$	$C_{M(\bar{C}/4)}$	$C_{M_{roll}}$	$C_{M_{yaw}}$	$\bar{X}(\bar{C}/4)$	$Z(\bar{C}/4)$	S	$\bar{C}$	b
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
---	---	---	---	---	---	---	---	---	---	---	---	---	---
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
*** AIRLOAD SUMS ***													
AC	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
CG	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
AC	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
CG	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑
* DETERMINANT= Δ * SCALE= S *													

### [B] ISURF Execution Mode

WING AIRLOAD COEFFICIENTS  
\*\*\*\*\*

	WCL	WCDI	WCMP	WCMR	WCMY	IXL	IYL	IZL	DELTA	SCALE
	$C_L$	$C_{D_i}$	$C_{M(\bar{C}/4)}$	$C_{M_{roll}}$	$C_{M_{yaw}}$	airload unit vector			Δ	S
WITH LF SUCTION	↓	↓	↓	↓	↓	↓	↓	↓		
NO LF SUCTION	↓	↓	↓	↓	↓	↓	↓	↓		

Note: Starred entries in the table (\*) refer to calculated values of vortex-lift increments.

## 5.2 Printed-Output Format Summary (Continued)

TABLE 5.05 - LINEARIZED (LIFTING-LINE) SOLUTIONS (ISURF Execution Mode Only)

### [A] Basic Lift Distribution

#### LINEARIZED SOLUTION WING COEFFICIENTS

\*\*\*\*\*

#### WITH LE SUCTION

#### NO LE SUCTION

ALFA	WCL $C_L$	WCD $C_D$	WCM(C/4) $C_{M(\bar{C}/4)}$	WCL $C_{L_v}$	WCD $C_{D_v}$	WCM(C/4) $C_{M_v(\bar{C}/4)}$
↓	↓	↓	↓	↓	↓	↓

### [B] Linearized Solutions

#### LINEARIZED SOLUTION WITH LE SUCTION

\*\*\*\*\*

ALFA	ALFARO	WCL	WCL SLOPE	CMR SLOPE	CMR SLOPE	CMY
$\alpha$	$\alpha_{R_0}$	$C_L$	$\bar{m}$	$\bar{m}_{pitch}$	$\bar{m}_{roll}$	$\bar{m}_{yaw}$

#### WITH LE SUCTION

#### NO LE SUCTION

#### FLAP/AILERON

Y	2Y/B	SCL	SCDI	SCM(C/4)	SCL	SCDI	SCM(C/4)	FCN	PCX	FCH
Y	Y/(b/2)	$c_l$	$c_{d_1}$	$c_{m(C/4)}$	$c_{l_v}$	$c_{d_{1,v}}$	$c_{m_v(C/4)}$	$c_{n_f}$	$c_{x_f}$	$c_{h_f}$
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

WITH LE SUCTION  
NO LE SUCTION

WCL =  $C_L$

/ WCDI =  $C_{D_1}$

/ WCM(C/4) =  $C_{M(\bar{C}/4)}$

/ L/D =  $C_L/C_{D_1}$

5.2 Printed-Output Format Summary (Continued)

TABLE 5.05 - LINEARIZED (LIFTING-LINE) SOLUTIONS (Continued)

[C] Spatially-Integrated Linearized Solutions

LINEARIZED SOLUTION WITH LE SUCTION *****						
ALFA	ALFARD	WCL	WCL SLOPE	CMR SLOPE	CMR SLOPE	CMY
$\alpha$	$\alpha R_0$	$C_L$	$\bar{m}$	$\bar{m}_{pitch}$	$\bar{m}_{roll}$	$\bar{m}_{yaw}$
Y	2Y/B	SCLA1	SCLB	SCL	SCM(1/4)	
Y	Y/(b/2)	$c_{la1}$	$c_{lb}$	$c_l$	$c_m(C/4)$	
↓	↓	↓	↓	↓	↓	

TABLE 5.06 - JOB/JOBS TERMINATION OUTPUT

[A] NSURF Execution Mode

\*\*\*\* JOB TIME= t<sub>1</sub> / ELAPSED TIME= t<sub>2</sub> / NO,PLOT FILES= n<sub>p</sub> / NSURF EXEC. VERSION 6-18-72 \*\*\*\*  
.....  
.....

[B] ISURF Execution Mode

\*\*\*\* JOB TIME= t<sub>1</sub> / ELAPSED TIME= t<sub>2</sub> / NO,PLOT FILES= n<sub>p</sub> / ISURF EXEC. VERSION 6-18-72 \*\*\*\*  
.....  
.....

## 5.2 Printed-Output Format Summary (Continued)

### 2) Long-Print Output

TABLE 5.07 - VORTEX-LATTICE GEOMETRY DETAIL (One for Each Surface)

J	K	Y	Z	WL	EW	DWL	DC	DS
j	k	Y	Z	W	$W - W_0$	$\Delta W$	$\Delta C$	$\Delta S$
↓	↓	↓	↓	↓	↓	↓	↓	↓

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
j	k	Coordinates of B(X,Y,Z)			Unit Vector $\vec{1B}$			Control Point P(X,Y,Z)			Normal Unit Vector $\vec{1N}$		
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓



## 5.2 Printed-Output Format Summary (Continued)

TABLE 5.08 - LIFT DISTRIBUTION DETAIL (One for Each Surface)

LIFT DISTRIBUTION DETAIL-SURFACE NO. = $N_j / (N_1, N_k)$													
J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
j	k	Coordinates of C(X,Y,Z)			$\Delta S$	$(c_{p_L} - c_{p_U})$	Unit Vector $\vec{IV}$			Induced Velocity Vector $\vec{V}_i$			$\Gamma_{j,k}$
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

### 3) Debug-Print Output

TABLE 5.09 - VORTEX-LATTICE INDUCED VELOCITY MATRICES DETAIL (One for Each Surface)

VORTEX LATTICE MATRIX DETAIL-SURFACE NO. = $N_j / (N_1, N_k)$														
J	K	NP	NG	VFS(MAT)	VIN(MAT)	P(X)	P(Y)	P(Z)	B(X)	B(Y)	B(Z)	D(X)	D(Y)	D(Z)
j	k	m	n	$\vec{V}_w \cdot \vec{IN}_n$	$\vec{V}_{m,n} \cdot \vec{IN}_n$	Control Point P(X,Y,Z) <sub>n</sub>			Coordinates of B(X,Y,Z) <sub>m</sub>			Coordinates of D(X,Y,Z) <sub>m</sub>		
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

## 5.2 Printed-Output Format Summary (Continued)

### 4) Program Checkout and Debug Print Output

TABLE 5.10 - PROGRAM CHECKOUT AND DEBUG PRINT

#### [A] Induced Velocity Calculation Detail-Print

Origin: Subroutine VORTEX (A13 or B11)

\$DEBUGV1		
P	= P(X,Y,Z)	} Branch $\infty$ -A-B
B	= B(X,Y,Z)	
D	= D(X,Y,Z)	
TANA	= Tan( $\alpha$ )	
GAMA	= $\Gamma$	
PSIF	= $\psi$	
VCOS	= $1\vec{V}_1$	
\$END		

\$DEBUGV2		
PSIF	= $\psi$	} Branch D-E- $\infty$
VCOS	= $1\vec{V}_1$	
\$END		

\$DEBUGV3		
PSIF	= $\psi$	} Branch B-C-D
VCOS	= $1\vec{V}_1$	
\$END		

#### [B] Ground Effect Mirror Image Calculation Detail-Print

Origin: Subroutine REFLEC (A10 or B12)

\$REFLEX	
PX	= X of P(X,Y,Z)
PY	= Y of P(X,Y,Z)
X1	= X coordinate for intermediate point
Y1	= Y coordinate for intermediate point
PHI	= $\phi$ , rotation angle (radians)
ALFAR	= $\alpha$ , angle of attack (radians)
RX	= X coordinate of mirror-image point
RY	= Y coordinate of mirror-image point
ZL	= Z coordinate to ground plane
COSR	= Cos( $\phi$ )
\$END	

### 5.3 Tape-Output Format Summary

In exercising the Calcomp/4060-microfilm plot-option of the program through the execution of XQT TRWPLT, the auxiliary execution mode, a data tape (or an internal unit) has to be provided in addition to the plotting instructions. The data tape is generated in the main execution modes of program, XQT NSURF or XQT ISURF, when the tape output option is specified in the input, i.e., NFLG(19)  $\neq$  0 or IFLG(12), IFLG(13), and IFLG(14)  $\neq$  0. The data in the data-tape is organized into a number of separate files, each file containing a single solution or a separate class of information. The data in each file is organized as illustrated below:

Execution Mode	File No.	Type of Information	Reference
NSURF	#1	Geometry for 1st. Surface	Example #1 (Section 6.2)
	#2	Geometry for 2nd. Surface	
	#3	Geometry for 3rd. Surface	
	#4	Geometry for 4th. Surface	
	#5		
	#6	Geometry for 5th. Surface	
	#7		
ISURF	#1	Geometry for 1st. Surface	Example #2 (Section 6.3)
	#2	Chordwise pressure distribution	
	#3	Spanwise airload distribution	
	#4	Linearized airload solution	

The data record format adopted for each file is given by

IREC, N, DATA<sub>1</sub>, DATA<sub>2</sub>, ....., DATA<sub>N</sub>,

IREC, N, DATA<sub>1</sub>, DATA<sub>2</sub>, ....., DATA<sub>N</sub>,

" " " " "

END OF FILE

where

IREC is the record type or number

N is the number of variables

DATA<sub>i</sub> is the i<sup>th</sup> variable in the record

The definition of the variables that are output in the data-tape is presented in Table 5.11.

TABLE 5.11 - TAPE-OUTPUT FORMAT SUMMARY

File	Execution Mode	Origin Routine No.	Record No. IREC	No. Words N	Data	Function
i	NSURF	A03	1	6	$X_{LE}, Y_{LE}, Z_{LE}, X_{TE}, Y_{TE}, Z_{TE},$	Isometric Projection of the $N^{th}$ Lifting-Surface Geometry
			2	3	$X_{F1}, Y_{F1}, Z_{F1},$	
			3	3	$X_{F2}, Y_{F2}, Z_{F2},$	
j	ISURF	B03	1	7	$Y, X_{LE}, X_{C/4}, X_{TE}, X_{HF}, C_W, C_F,$	Ortographic Projection of the $I^{th}$ Lifting-Surface Geometry
			2	2	$Y_{F1}, X_{F1},$	
			3	2	$Y_{F2}, X_{F2},$	
			4	3	$Y, Z_{LE}, Z_{TE},$	Isometric Projection of the $I^{th}$ Lifting-Surface Geometry
			5	6	$X_{LE}, Y_{LE}, Z_{LE}, X_{TE}, Y_{TE}, Z_{TE},$	
			6	3	$X_{F1}, Y_{F1}, Z_{F1},$	
			7	3	$X_{F2}, Y_{F2}, Z_{F2},$	
k	ISURF	B05	1	2	$X/C, (c_{PU} - c_{PL})$	Chordwise Pressure Distribution
			2	10	$Y/b, c_l, c_d, c_m(C/4), c_{n_f}, c_{x_f}, c_{h_f},$ $c_{l_v}, c_{d_v}, c_{m_v}(C/4),$	Span Distribution of Section Airload Coefficients for Vortex-Lattice Solution
l	ISURF	B06	1	10	$Y/b, c_l, c_d, c_m(C/4), c_{n_f}, c_{x_f}, c_{h_f},$ $c_{l_v}, c_{d_v}, c_{m_v}(C/4)$	Span Distribution of Section Airload Coefficients for Linearized Solutions
			2	7	$\alpha, C_L, C_D, C_M(\bar{C}/4), C_{L_v}, C_{D_v}, C_{M_v}(\bar{C}/4),$	Spatially-Integrated Airload Coefficients

#### 5.4 Execution Diagnostics and Job Abort Output

Aside from the system (the computer) diagnostic error messages that may be output in the normal execution of the program, diagnostic or job termination messages are output when unallowable errors are incurred in the execution. Generally, these errors result because of bad input or because some of the calculated dependent variables fall outside the range of the program. A complete list of the error messages that may be output by the program and the corrective action that should be taken for each individual case is presented below:

1) JOB ABORTED BECAUSE, NO. OF LIFTING SURFACES = N EXCEEDS FIVE

Origin: Subroutine LØFT (A03)

Cause: The number of lifting surfaces specified in the input exceeds the maximum number of lifting surfaces allowed in execution.

Correction: The absolute value sum of NWING, NFUS, and NVTAIL must be less than or equal to five. Revise accordingly.

2) JOB ABORTED BECAUSE, NO. OF SPAN ELEMENTS = NSE EXCEEDS 60

Origin: Subroutine LØFT (A03)

Cause: The number of spanwise elements of the vortex-lattice geometric configuration exceeds the maximum number of allowable elements.

Correction: Decrease the number of spanwise elements in the vortex-lattice by revising the entries in NFLG(1), NFLG(2), ..., NFLG(5).

3) JOB ABORTED BECAUSE, NO. OF CHORD ELEMENTS = NCE EXCEEDS TEN

Origin: Subroutine LØFT (A03)

Cause: The vortex-lattice number of chordwise elements assigned to the N<sup>th</sup> surface exceeds the maximum allowable number.

Correction: The value assigned to NFLG(6), NFLG(7), 1, or, NFLG(10) cannot exceed 10. Revise these entries accordingly.

#### 5.4 Execution Diagnostics and Job Abort Output (Continued)

4) JOB ABORTED BECAUSE, NO. OF VORTEX-LATTICE ELEMENTS = NVME EXCEEDS 100

Origin: Subroutine LIFTX (A04)

Cause: Too many elemental panels are considered simultaneously in obtaining a solution, i.e., the number of elements in the induced-velocity matrix exceeds the maximum allowable number.

Correction: A smaller number of lifting-surfaces or a smaller number of elemental panels per surface has to be considered in obtaining a solution. To achieve these objectives revise the entries made for NSOLV, and NFLG(1) through NFLG(10).

5) JOB ABORTED BECAUSE, MACH NO. = MACHN EXCEEDS 0.90

Origin: Subroutine MAIN (A01)

Cause: The free stream Mach Number assigned to a given solution exceeds the maximum allowable limit of the program.

Correction: Revise the entries made for the MACHN array.

6) JOB ABORTED BECAUSE, NO. OF SPAN STATIONS = NSS EXCEEDS 30

Origin: Subroutine LOFT (A03)

Cause: Too much data input for the X, Y, Z, E, C, and XOCR arrays.

Correction: Revise entries for NSS, X, Y, Z, E, C, and XOCR.

7) JOB ABORTED BECAUSE, NO. OF CHORD STATIONS = NSC EXCEEDS 10

Origin: Subroutine LOFT (A03)

Cause: Too much data input for XOC and ZOC arrays.

Correction: Revise entries for NCS, XOC, and ZOC.

8) JOB ABORTED BECAUSE, NO. OF SPAN ELEMENTS = NSPE NOT PERMITTED

Origin: Subroutine LOFT (A03)

Cause: The number of span elements assigned to any lifting surface has to be a positive integer.

Correction: Revise (increase) entries for NFLG(1), through NFLG(5).

#### 5.4 Execution Diagnostics and Job Abort Output (Continued)

9) JOB ABORTED BECAUSE, NO. OF WING CHORD ELEMENTS = NWCE NOT PERMITTED

Origin: Subroutine LØFT (A03)

Cause: Too few chordwise elements assigned to the N<sup>th</sup> lifting surface.

Correction: Revise (increase) entries for NFLG(6) through NFLG(10).

10) JOB ABORTED BECAUSE, INPUT ERROR IN NSS FLAG, NSS(N) = 11.LT.NSS(M)=12

Origin: Subroutine LØFT (A03)

Cause: Input error incurred in the NSS array specification.

Correction: Revise entries for NSS array.

## 5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES

### \* PROGRAM OUTPUT OPTIONS \*

- |                           |                                     |
|---------------------------|-------------------------------------|
| (1) - SHORT-PRINT OUTPUT, | NFLG(20).OR.IFLG(10).EQ,0,          |
| (2) - LONG-PRINT OUTPUT,  | NFLG(20).OR.IFLG(10).GE,2,          |
| (3) - DEBUG-PRINT OUTPUT, | NFLG(20).OR.IFLG(10).GE,5,          |
| (4) - PROGRAM-CHECKOUT,   | NFLG(20).OR.IFLG(10).GE,8,          |
| (5) - PLOT TAPE OUTPUT,   | NFLG(19).OR.(IFLG(I),I=11,14).GE,1, |

### \* INPUT-DATA OUTPUT - NAMELIST INPUT \*

NAMELIST INPUT, SEE INPUT VARIABLES LIST (SECTION 3.4) FOR DEFINITION OF INPUT VARIABLES IN NAMELIST INPUT.

### \* STANDARD-PRINT OUTPUT - SHORT-PRINT, LONG-PRINT, OR DEBUG-PRINT \*

VARIABLE	COMMENT	UNITS †	DEFINITION
AC	INTG,COEFF,		AERODYNAMIC CENTER FOR ELEMENTAL SURFACE NO. 1.
ALFA		DEG,	ANGLE OF ATTACK MEASURED RELATIVE TO THE FREE STREAM VECTOR AND THE X-COORDINATE AXIS,
ALFARØ	ISURF	DEG,	WING ANGLE OF ATTACK FOR CL=0,0,
ALTITUDE		L	ALTITUDE ABOVE THE GROUND PLANE, I.E., THE SHORTEST STRAIGHT-LINE DISTANCE MEASURED FROM THE COORDINATE SYSTEM ORIGIN (X=Y=Z=0) TO THE GROUND PLANE,
AREA	GEOMETRY	L**2	PROJECTED AREA OF LIFTING SURFACE.
AREA	ND.GE,2	L**2	AREA OF AN ELEMENTAL SURFACE.
AREA S(CG)	GEOMETRY	L**2	REFERENCE AREA USED FOR NORMALIZING THE C.G. AERODYNAMIC COEFFICIENTS,
ASPECT RATIO	GEOMETRY		ASPECT RATIO OF LIFTING SURFACE, I.E., EQUAL TO (SPAN**2)/AREA
B(X)	ND.GE,5	L	X-COORDINATE OF POINT B(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D,
B(Y)	ND.GE,5	L	Y-COORDINATE OF POINT B(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D,
B(Z)	ND.GE,5	L	Z-COORDINATE OF POINT B(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D,
C(FLAP)	GEOMETRY	L	CHORD LENGTH OF FLAP AND/OR AILERONS,

†Blank entries denote dimensionless quantities.



# 5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
C(TAB)	GEOMETRY	L	CHORD LENGTH OF TAB OR AUXILIARY FLAP SURFACE,
C(WING)	GEOMETRY	L	CHORD LENGTH OF LIFTING SURFACE CHORD-PLANE,
CG	INTG.COEFF.		CENTER OF GRAVITY LOCATION DEFINED BY REFERENCE DIMENSIONS,
CHORD C(CG)	GEOMETRY	L	REFERENCE CHORD LENGTH USED FOR NORMALIZING THE C.G. AERODYNAMIC COEFFICIENTS,
CMP SLOPE	ISURF		WING PITCHING MOMENT COEFFICIENT SLOPE, I.E., = D(WCMP)/D(ALFA),
CMR SLOPE	ISURF		WING ROLLING MOMENT COEFFICIENT SLOPE, I.E., = D(WCMR)/D(ALFA),
CMY SLOPE	ISURF		WING YAWING MOMENT COEFFICIENT SLOPE, I.E., = D(WCMY)/D(ALFA),
CPN	ND.GE,2		NORMAL FORCE PRESSURE COEFFICIENT FOR AN ELEMENTAL SURFACE,
D(X)	ND.GE,5	L	X-COORDINATE OF POINT D(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D,
D(Y)	ND.GE,5	L	X-COORDINATE OF POINT D(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D,
D(Z)	ND.GE,5	L	X-COORDINATE OF POINT D(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D,
DC	ND.GE,1	L	CHORD INCREMENT OF A VORTEX-LATTICE ELEMENTAL SURFACE.
*DETERMINANT	INTG.COEFF.		VALUE OF DETERMINANT IN VORTEX-LATTICE MATRIX INVERSION,
DIHED(MGC/4)	GEOMETRY	DEG.	DIHEDRAL ANGLE BASED ON THE 1/4-CHORD LOCATION OF THE MEAN GEOMETRIC CHORD AND ROOT CHORD SPAN STATIONS,
DS	ND.GE,1	L**2	TRUE AREA INCREMENT OF A VORTEX-LATTICE ELEMENTAL SURFACE.
DWL	ND.GE,1	L	TRUE SPAN DIMENSION OF A VORTEX-LATTICE ELEMENTAL SURFACE.
E	INTG.COEFF.		DESIGNATION OF ELEMENTAL SURFACE (NTH SURFACE),
EB	INTG.COEFF.	L	SPAN OF ELEMENTAL SURFACE.
ECD	INTG.COEFF.		INDUCED DRAG COEFFICIENT FOR ELEMENTAL SURFACE,
ECL	INTG.COEFF.		LIFT COEFFICIENT FOR ELEMENTAL SURFACE,
ECMP	INTG.COEFF.		PITCHING MOMENT COEFFICIENT FOR ELEMENTAL SURFACE.
ECMR	INTG.COEFF.		ROLLING MOMENT COEFFICIENT FOR ELEMENTAL SURFACE.
ECMY	INTG.COEFF.		YAWING MOMENT COEFFICIENT FOR ELEMENTAL SURFACE

## 5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
ECN	INTG.COEFF.		NORMAL FORCE COEFFICIENT FOR ELEMENTAL SURFACE.
ECX	INTG.COEFF.		HORIZONTAL FORCE COEFFICIENT FOR ELEMENTAL SURFACE.
ECY	INTG.COEFF.		SIDE FORCE COEFFICIENT FOR ELEMENTAL SURFACE.
ELAPSED TIME	COMMENT		TIME ELAPSED SINCE START OF EXECUTION.
EMGC	INTG.COEFF.	L	MEAN GEOMETRIC CHORD OF ELEMENTAL SURFACE.
ES	INTG.COEFF.	L**2	AREA OF ELEMENTAL SURFACE.
EW	ND.GE,1	L	TRUE SPAN COORDINATE MEASURED AT POINT B OF AN ELEMENTAL SURFACE VORTEX FILAMENT.
EXA	INTG.COEFF.	L	LONGITUDINAL STATION FOR 1/4-CHORD POINT LOCATION OF ELEMENTAL SURFACE MEAN GEOMETRIC CHORD.
EZA	INTG.COEFF.	L	WATERLINE STATION FOR 1/4-CHORD POINT LOCATION OF ELEMENTAL SURFACE MEAN GEOMETRIC CHORD.
FCH	ISURF		HINGE MOMENT SECTION COEFFICIENT FOR FLAP OR AILERON CONTROL SURFACES.
FCN	ISURF		NORMAL FORCE SECTION COEFFICIENT FOR FLAP OR AILERON CONTROL SURFACES.
FCX	ISURF		CHORDWISE FORCE SECTION COEFFICIENT FOR FLAP OR AILERON CONTROL SURFACES.
FLAP DEFLEC	GEOMETRY	DEG.	FLAP DEFLECTION, I.E., + = DOWN.
FLAP SPAN1	GEOMETRY L OR L/B		SPAN LOCATION OF THE INNER EDGE OF THE FLAP.
FLAP SPAN2	GEOMETRY L OR L/B		SPAN LOCATION OF THE OUTER EDGE OF THE FLAP OR INNER EDGE OF THE AILERON.
FLAP SPAN3	GEOMETRY L OR L/B		SPAN LOCATION OF THE OUTER EDGE OF THE AILERON.
FUS STA X(CG)	GEOMETRY	L	LONGITUDINAL STATION (X-COORDINATE) FOR THE LOCATION OF THE CENTER OF GRAVITY.
GAMA	ND.GE,2		STRENGTH OR CONCENTRATED VORTICITY FOR THE VORTEX FILAMENT OF AN ELEMENTAL SURFACE DEFINED BY THE POINTS B(X,Y,Z) AND D(X,Y,Z).
G(X)	ND.GE,2		X-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE LINE OF ACTION OF THE LIFT FORCE ACTING ON AN ELEMENTAL SURFACE.
G(Y)	ND.GE,2		Y-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE LINE OF ACTION OF THE LIFT FORCE ACTING ON AN ELEMENTAL SURFACE.
G(Z)	ND.GE,2		Z-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE LINE OF ACTION OF THE LIFT FORCE ACTING ON AN ELEMENTAL SURFACE.
J			SPAN ARGUMENT OR INDEX.
JOB TIME	COMMENT		TIME ELAPSED FOR EXECUTION OF LAST JOB.

## 5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
K			CHORD ARGUMENT OR INDEX.
L/D	ISURF		LIFT TO DRAG RATIO.
LAIL DEFLEC	GEOMETRY	DEG.	LEFT AILERON DEFLECTION, I.E., + = DOWN, AND, - = UP.
MACHN			MACH NUMBER OF THE FREE STREAM VELOCITY.
MEAN CHORD	GEOMETRY	L	MEAN CHORD OF LIFTING SURFACE, I.E., EQUAL TO AREA/SPAN
MGC (MAC)	GEOMETRY	L	MEAN GEOMETRIC CHORD THAT IS DEFINED EQUAL TO THE MEAN AERODYNAMIC CHORD.
ND	OUTPUT		VALUE ASSIGNED TO NFLG(20) OR IPLG(10).
NG	ND.GE,5		SECOND ARGUMENT OR INDEX OF VORTEX-LATTICE INFLUENCE COEFFICIENT MATRIX.
NØ,CHORD DISCØN.	GEOMETRY		NUMBER OF CHORD DISCONTINUITIES FOR THE LIFTING SURFACE VORTEX-LATTICE REPRESENTATION.
NØ,CHORD ELEMENTS	GEOMETRY		NUMBER OF CHORD ELEMENTS FOR THE LIFTING-SURFACE VORTEX-LATTICE REPRESENTATION.
NØ,PLØT FILES	COMMENT		NUMBER OF FILES OUTPUT ON UNIT KT2 THAT ARE USED IN THE PROGRAM PLOTTING OPTION.
NØ,SPAN ELEMENTS	GEOMETRY		NUMBER OF SPAN ELEMENTS FOR THE LIFTING-SURFACE VORTEX-LATTICE REPRESENTATION.
NP	ND.GE,5		FIRST ARGUMENT OR INDEX OF VORTEX-LATTICE INFLUENCE COEFFICIENT MATRIX.
P(X)	ND.GE,2	L	X-COORDINATE OF A FIELD POINT ABOUT WHICH THE INDUCED VELOCITY IS CALCULATED.
P(Y)	ND.GE,2	L	Y-COORDINATE OF A FIELD POINT ABOUT WHICH THE INDUCED VELOCITY IS CALCULATED.
P(Z)	ND.GE,2	L	Z-COORDINATE OF A FIELD POINT ABOUT WHICH THE INDUCED VELOCITY IS CALCULATED.
ROOT CHORD	GEOMETRY	L	CHORD LENGTH OF THE ROOT STATION.
ROOT TWIST	GEOMETRY	DEG.	GEOMETRIC TWIST OF CHORD PLANE AT THE ROOT, STATION (WASHIN), WHERE, + = LEADING EDGE UP, AND - = LEADING EDGE DOWN.
R,AIL DEFLEC	GEOMETRY	DEG.	RIGHT AILERON DEFLECTION, I.E., + = DOWN, AND, - = UP.
*SCALE	INTG.COEFF.		AVERAGE VALUE OF ELEMENTS IN THE VORTEX-LATTICE MATRIX
SCD	SECT.COEFF.		SECTION DRAG COEFFICIENT.
SCDI	ISURF		SECTION COEFFICIENT FOR INDUCED DRAG.
SCL	SECT.COEFF.		SECTION LIFT COEFFICIENT.
SCLA1	ISURF		ADDITIONAL LIFT DISTRIBUTION SECTION LIFT COEFFICIENT.

# 5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
SCLB	ISURF		BASIC LIFT DISTRIBUTION (WCL=0.0) SECTION LIFT COEFFICIENT.
SCLC/B	SECT.COEFF.		SECTION SPAN LOADING COEFFICIENT, I.E., $SCL \cdot (C/B)$ .
SCN	SECT.COEFF.		SECTION NORMAL AIRLOAD COEFFICIENT, I.E., ACTING IN THE -Z DIRECTION.
SCX	SECT.COEFF.		SECTION CHORDWISE AIRLOAD COEFFICIENT, I.E., ACTING IN THE +X DIRECTION.
SMP C/4	SECT.COEFF.		SECTION PITCHING-MOMENT COEFFICIENT ABOUT THE LOCAL 1/4-CHORD LOCATION.
SPAN	GEOMETRY	L	SPAN OF LIFTING SURFACE.
SPAN B(CG)	GEOMETRY	L	REFERENCE SPAN LENGTH USED FOR NORMALIZING THE C.G. AERODYNAMIC COEFFICIENTS.
SWEEP(MGC/4)	GEOMETRY	DEG.	SWEEPBACK ANGLE BASED ON THE 1/4-CHORD LOCATION OF THE MEAN GEOMETRIC CHORD AND ROOT CHORD SPAN STATIONS.
TAB DEFLEC	GEOMETRY	DEG.	TAB DEFLECTION, I.E., + = DOWN, AND, - = UP.
TIP CHORD	GEOMETRY	L	CHORD LENGTH OF THE TIP STATION.
TIP TWIST	GEOMETRY	DEG.	GEOMETRIC TWIST OF CHORD PLANE AT THE TIP, STATION (WASHOUT), WHERE, + = LEADING EDGE UP, AND - = LEADING EDGE DOWN.
TWIST	GEOMETRY	DEG.	GEOMETRIC TWIST OF THE CHORD PLANE, WHERE, + = LEADING EDGE UP, AND, - = LEADING EDGE DOWN.
VFS(MAT)	ND.GE,5	V/UFS	FREE STREAM VECTOR VELOCITY COMPONENT NORMAL TO THE ELEMENTAL SURFACE AT THE COLOCATION POINT P(X,Y,Z).
VIN(MAT)	ND.GE,5	V/UFS	INDUCED VELOCITY VECTOR COMPONENT NORMAL TO THE ELEMENTAL SURFACE AT THE COLOCATION POINT P(X,Y,Z) DUE TO THE VORTEX FILAMENT DEFINED BY B(X,Y,Z) AND D(X,Y,Z) POINTS.
VI(X)	ND.GE,2	V/UFS	X-COMPONENT OF THE VELOCITY VECTOR INDUCED BY THE SUM OF ALL ELEMENTAL SURFACE VORTEX FILAMENTS.
VI(Y)	ND.GE,2	V/UFS	Y-COMPONENT OF THE VELOCITY VECTOR INDUCED BY THE SUM OF ALL ELEMENTAL SURFACE VORTEX FILAMENTS.
VI(Z)	ND.GE,2	V/UFS	Z-COMPONENT OF THE VELOCITY VECTOR INDUCED BY THE SUM OF ALL ELEMENTAL SURFACE VORTEX FILAMENTS.
W	SECT.COEFF.	L	CUMULATIVE WETTED-SPAN DIMENSION IN CORE.
WCDI	ISURF		WING INDUCED DRAG COEFFICIENT.
WCL	ISURF		WING LIFT COEFFICIENT.
WCL SLOPE	ISURF		WING LIFT SLOPE, I.E., $WCL / (\alpha - \alpha_{FAR})$

## 5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
WCMP	ISURF		WING PITCHING MOMENT COEFFICIENT ABOUT 1/4 MAC. (MAC= MEAN AERODYNAMIC CHORD)
WCMR	ISURF		WING ROLLING MOMENT COEFFICIENT,
WCMY	ISURF		WING YAWING MOMENT COEFFICIENT,
WING STA Y(CG)	GEOMETRY	L	SPAN STATION (Y-COORDINATE) FOR THE LOCATION OF THE CENTER OF GRAVITY,
WL	ND.GE,1	L	SPAN COORDINATE IN-CORE FOR POINT B OF AN ELEMENTAL SURFACE VORTEX FILAMENT,
WL STA Z(CG)	GEOMETRY		VERTICAL WATER-LINE STATION (Z-COORDINATE) FOR THE LOCATION OF THE CENTER OF GRAVITY,
WS	GEOMETRY	L	WETTED-LENGTH SPAN STATION,
X		L	X-COORDINATE DEFINED FOR A RIGHT-HAND LOFT COORDINATE SYSTEM,
XA(N)/C	CAMBER	L/C	CHORD STATION NORMALIZED BY CHORD LENGTH FOR THE NTH-LOCATION, N=1,2,3,.....,10,
XBAR	GEOMETRY	L	LONGITUDINAL COORDINATE FOR THE 1/4-CHORD LOCATION OF THE MEAN GEOMETRIC CHORD,
X(C/4)	GEOMETRY	L	LONGITUDINAL STATION (X-COORDINATE) OF THE 1/4-CHORD LOCATION OF THE CHORD PLANE,
X(LE)	GEOMETRY	L	LONGITUDINAL STATION (X-COORDINATE) OF THE LEADING EDGE OF THE CHORD PLANE,
XN	ND.GE,1	L	X-COORDINATE OF THE COLOCATION POINT OF AN ELEMENTAL SURFACE,
X(TE)	GEOMETRY	L	LONGITUDINAL STATION (X-COORDINATE) OF THE TRAILING EDGE OF THE CHORD PLANE,
XV	ND.GE,1	L	X-COORDINATE OF POINT B OF AN ELEMENTAL SURFACE VORTEX FILAMENT,
Y		L	Y-COORDINATE DEFINED FOR A RIGHT-HAND LOFT COORDINATE SYSTEM,
Y*	SECT.COEFF,		DIMENSIONLESS SPAN COORDINATE, I.E., Y/SPAN,
YBAR	GEOMETRY	L	SPAN COORDINATE FOR THE 1/4-CHORD LOCATION OF THE MEAN GEOMETRIC CHORD,
YN	ND.GE,1	L	Y-COORDINATE OF THE COLOCATION POINT OF AN ELEMENTAL SURFACE,
YV	ND.GE,1	L	Y-COORDINATE OF POINT B OF AN ELEMENTAL SURFACE VORTEX FILAMENT
Z		L	Z-COORDINATE DEFINED FOR A RIGHT-HAND LOFT COORDINATE SYSTEM,
ZA(N)/C	CAMBER	L/C	VERTICAL LOCATION OF MEAN-CAMBER PLANE RELATIVE TO THE CHORD PLANE AND NORMALIZED BY THE CHORD,
ZBAR	GEOMETRY	L	VERTICAL COORDINATE FOR THE 1/4-CHORD LOCATION OF THE MEAN GEOMETRIC CHORD,

# 5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
ZN	ND.GE,1	L	Z-COORDINATE OF THE COLOCATION POINT OF AN ELEMENTAL SURFACE.
ZV	ND.GE,1	L	Z-COORDINATE OF POINT B OF AN ELEMENTAL SURFACE VORTEX FILAMENT
1XL	SECT.COEFF.		UNIT VECTOR IN THE +X DIRECTION FOR SECTION AIRLOAD.
1XN	ND.GE,1		X-COMPONENT OF THE NORMAL-UNIT-VECTOR AT THE COLOCATION POINT OF AN ELEMENTAL SURFACE.
1XV	ND.GE,1		X-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE SPANWISE ORIENTATION OF THE VORTEX FILAMENT OF AN ELEMENTAL SURFACE.
1YL	SECT.COEFF.		UNIT VECTOR IN THE +Y DIRECTION FOR SECTION AIRLOAD.
1YN	ND.GE,1		Y-COMPONENT OF THE NORMAL-UNIT-VECTOR AT THE COLOCATION POINT OF AN ELEMENTAL SURFACE.
1YV	ND.GE,1		Y-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE SPANWISE ORIENTATION OF THE VORTEX FILAMENT OF AN ELEMENTAL SURFACE.
1ZL	SECT.COEFF.		UNIT VECTOR IN THE +Z DIRECTION FOR SECTION AIRLOAD.
1ZN	ND.GE,1		Z-COMPONENT OF THE NORMAL-UNIT-VECTOR AT THE COLOCATION POINT OF AN ELEMENTAL SURFACE.
1ZV	ND.GE,1		Z-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE SPANWISE ORIENTATION OF THE VORTEX FILAMENT OF AN ELEMENTAL SURFACE.

\* PROGRAM-CHECKOUT OUTPUT - NAMELIST DBUGV1, DBUGV2, DBUGV3, OR REFLEX \*

VARIABLE	COMMENT	UNITS	DEFINITION
ALFAR	ND.GT,15	RAD.	ANGLE OF ATTACK.
B	ND.GE,5	L	X-Y-Z COORDINATES OF POINT B(X,Y,Z) THAT DEFINES THE LOCATION OF THE ELEMENTAL VORTEX FILAMENT B-D.
COSR	ND.GT,15		COSINE(ALFAR).
D	ND.GE,5	L	X-Y-Z COORDINATES OF POINT D(X,Y,Z) THAT DEFINES THE LOCATION OF THE ELEMENTAL VORTEX FILAMENT B-D.
GAMA	ND.GE,5		STRENGTH OR CONCENTRATED VORTICITY OF THE VORTEX FILAMENT B-D.
P	ND.GE,5	L	X-Y-Z COORDINATES OF THE FIELD POINT P(X,Y,Z).
PHI	ND.GT,15	RAD.	ROTATION ANGLE.

## 5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
PSIF	ND.GE,5		INFLUENCE FUNCTION PSI,
PX	ND.GT,15	L	X-COORDINATE,
PY	ND.GT,15	L	Y-COORDINATE,
RX	ND.GT,15	L	X-COORDINATE FOR IMAGE POINT,
RY	ND.GT,15	L	Y-COORDINATE FOR IMAGE POINT,
TANA	ND.GE,5		TANGENT OF ALPHA,
VCØS	ND.GE,5		X-Y-Z COMPONENTS OF THE INDUCED VELOCITY VECTOR AT POINT P(X,Y,Z) DUE TO THE VORTEX FILAMENT B-D,
X1	ND.GT,15	L	X-COORDINATE FOR INTERMEDIATE POINT,
Y1	ND.GT,15	L	Y-COORDINATE FOR INTERMEDIATE POINT,
ZL	ND.GT,15	L	ALTITUDE,

## 5.6 LIST OF ABBREVIATIONS FOR OUTPUT

-----

ALFA      ANGLE OF ATTACK

AIL        AILERON

ASSIG.    ASSIGNMENT

CAMBER    AIRFOIL SECTION MEAN CAMBER SPECIFICATIONS

CL         LIFT COEFFICIENT

CØNS.    CONSTANT

C.G.       CENTER OF GRAVITY

DEG.       ANGLE MEASURED IN DEGREES

DIM.       DIMENSION

.EQ.       EQUAL

E.G.       FOR EXAMPLE

GEØMETRY   LIFTING SURFACE GEOMETRY SPECIFICATIONS

.GE.       GREATER OR EQUAL

.GT.       GREATER THAN

INTG.CØEFF.      SPATIALLY-INTEGRATED COEFFICIENTS

I.E.       EQUIVALENT TO

## 5.6 LIST OF ABBREVIATIONS FOR OUTPUT (CONTINUED)

L	LINEAR DIMENSION
.LE.	LESS OR EQUAL
.LT.	LESS THAN
L/B	LINEAR DIMENSION NORMALIZED BY THE SPAN
L/C	LINEAR DIMENSION NORMALIZED BY THE CHORD
L**2	AREA UNITS, I.E., LINEAR UNITS SQUARED
ND,GE,1	NFLAG(20) OR IFLAG(10) GREATER OR EQUAL TO 1
ND,GE,2	NFLAG(20) OR IFLAG(10) GREATER OR EQUAL TO 2
ND,GE,5	NFLAG(20) OR IFLAG(10) GREATER OR EQUAL TO 5
ND,GT,15	NFLAG(20) OR IFLAG(10) GREATER THAN 15
ØPT.	OPTIONAL
RAD.	ANGLE MEASURED IN RADJANS
REF	REFERENCE
SECT,CØEFF.	AIRLOAD SECTION COEFFICIENTS
SURF.	SURFACE
V/UFS	VELOCITY NORMALIZED BY THE FREE STREAM VELOCITY
*	MULTIPLICATION
**	EXPONENTIATION



## 6.1 INPUT-DATA LISTINGS

[illegible]

120 PUNCHED-CARDS INPUT DECK  
REQUIRED FOR XQT TRWPLT  
(PLOT-OPTION)

ORIGINAL PAGE IS  
OF POOR QUALITY

- GENERAL NOTES: 1.  $\nabla$  = 7/8 PUNCH  
2. COMMENTS ARE PRINTED IN "ITALIC TYPE"  
3. DASHED-LINES INDICATE THE START OF A NEW OUTPUT PAGE (-----)  
4. BROKEN-SOLID-LINES INDICATES OUTPUT HAS BEEN EDITED (-----)

6.1 INPUT-DATA LISTINGS (CONTINUED)

```

      NQADV = 1
      PLOT = 2,2, 3,2, ENDLST
    ENDPLOT
      NQADV = 1
      PLOT = 2,3, 3,3, ENDLST
    ENDPLOT
  ENDFIL
      NQADV = 1
      PLOT = 2,1, 3,1, ENDLST
    ENDPLOT
      NQADV = 1
      PLOT = 5,1, 6,1, ENDLST
    ENDPLOT
      NQADV = 1
      PLOT = 2,2, 3,2, ENDLST
    ENDPLOT
      NQADV = 1
      PLOT = 2,3, 3,3, ENDLST
    ENDPLOT
  ENDFIL
      NQADV = 1
      PLOT = 2,1, 3,1, ENDLST
    ENDPLOT
      NQADV = 1
      PLOT = 5,1, 6,1, ENDLST
    ENDPLOT
      NQADV = 1
      PLOT = 2,2, 3,2, ENDLST
    ENDPLOT
      NQADV = 1
      PLOT = 2,3, 3,3, ENDLST
    ENDPLOT
  ENDFIL
      NQADV = 1
      PLOT = 2,1, 3,1, ENDLST
    ENDPLOT
      NQADV = 1
      PLOT = 5,1, 6,1, ENDLST
    ENDPLOT
      NQADV = 1
      PLOT = 2,2, 3,2, ENDLST
    ENDPLOT
      NQADV = 1
      PLOT = 2,3, 3,3, ENDLST
    ENDPLOT
  ENDFIL
      NQADV = 1
      PLOT = 2,1, 3,1, ENDLST
    ENDPLOT
      NQADV = 1
      PLOT = 5,1, 6,1, ENDLST
    ENDPLOT
      NQADV = 1
      PLOT = 2,2, 3,2, ENDLST
    ENDPLOT
      NQADV = 1
      PLOT = 2,3, 3,3, ENDLST
    ENDPLOT
  ENDFIL
    ENDRUN
  /EOF

```

## 6.1 INPUT-DATA LISTINGS (CONTINUED)

### EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION

```

RUN T54889.TRW.1002,3303A,1002,C,5.1          GOMEZ TRW
VN MSC FILE REQ. TAPE 1 FH432 J FSTRN 1
V ASC N=10202
V ASO F
V PLT
V XQT CUR
TWL A
EFS
PFF A
IN X
V XQT ISURF
EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION
TASK 702, PROJECT 3303A, MJO 147033, AERODYNAMIC ANALYSIS AND DESIGN
SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. HA010B (NSURF)
                                  A.V.GOMEZ/ 5 JULY 1972

$INPUT
NGS=2, NC6=2, IFLG(2)=0.16,0, IFLG(3)=1.4,0, IFLG(8)=1, IFLG(10)=5,
X=2=0.0, Y=0.0, Z=0.0, E=2=0.0, C=15.0,5.0, XCDC=0.25, XOC=0.0,1.0,
WFLAP1=0., WFLAP2=0.625, WFLAP3=1.0, FLAPC=0.25, VSMOTW=0.25,
PNECF=1, LDRAQ=1, CLEANF=0.0035, NJOB=1, MACMN=9.2, ALFA=B, DELALF=-12,
FLAPDJ=30.0, AILDJ=10.0,-15.0,
KT2=8, IFLG(11)=4+1,
NJDBL=9, WCL=1, 0.,0.25,0.5,0.75,1.0,1.25,1.5,1.75,2.0,
SENO
V XQT TRWPLT
KUNIT = 8
ICCOMP = 0
NTRAN = 0
IPRINT = 0
NTYPE = 0
NOFSCL = 1
ISCALY = 1,1,1,1,1,1,1,1,1,1,1
NXI = 24
NYR = 24
NYL = 24
NYH = 24
NPOSNI = 600, 950
NPOSNI = 600, 925
NPOSNI = 600, 900
NPOSNI = 600, 50
CHARSZ = 1.0, 1.0, 1.0, 1.0
ANNOT1 = 10 = EXAMPLE PROB. 2 - SINGLE-SURFACE
ANNOT2 = 10 = CAPABILITY DEMONSTRATION RUN
ANNOT3 = 10 = A.GOMEZ/ 5 JULY 72
ANNOT4 = 10 =
TITLE = 10 = LIFTING SURFACE PLANFORM GEOMETRY
XLABEL = 10 = HORIZONTAL AXIS, SEMISPANS
YLABEL = 10 = VERTICAL AXIS, SEMISPANS
XLO =-1.1
XHI = 1.1
YLO = -1.5
YHI = 1.7
PLOT = 1.1, 2.1, 4.1, ENDLST
ENDPLT
ANOTSU = 0
NOADV = 1
PLOT = 1.2, 2.2, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.3, 2.3, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.4, 2.4, 3.4, ENDLST
ENDPLT
TITLE = 10 = ISOMETRIC PROJECTION OF WING PLANFORM
YLO = -1.1
YHI = 1.1
PLOT = 1.5, 2.5, ENDLST
ENDPLT
NOADV = 1
PLOT = 3.5, 4.5, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.6, 2.6, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.7, 2.7, ENDLST
ENDPLT
PLOT = 5.5, 2.5, ENDLST
ENDPLT
NOADV = 1
PLOT = 6.5, 4.5, ENDLST
ENDPLT
NOADV = 1
PLOT = 3.6, 2.6, ENDLST
ENDPLT
NOADV = 1
PLOT = 3.7, 2.7, ENDLST
ENDPLT
ENDDFIL
ANNOT1 = 10 = EXAMPLE PROB. 2 - SINGLE-SURFACE
ANNOT2 = 10 = CAPABILITY DEMONSTRATION RUN
ANNOT3 = 10 = A.GOMEZ/ 5 JULY 72
ANNOT4 = 10 =
CHARSZ = 1.0, 1.0, 1.0, 1.0
TITLE = 10 = CHORDWISE PRESSURE DISTRIBUTION {CPL-CPU}
XLABEL = 10 = HORIZONTAL DISTANCE, CHORDS
YLABEL = 10 = DIFFERENTIAL PRESSURE COEFFICIENT
XLO = 0.0
XHI = 3.2
YLO =-3.0
YHI = 9.0
CADD = 9.0, 9.0
PLOT = 1.1, 2.1, ENDLST
ENDPLT
NOADV = 1
CADD = 3.2, 0.5
PLOT = 1.2, 2.2, ENDLST
ENDPLT

```

14 PUNCHED-CARDS INPUT DECK  
REQUIRED FOR XQT ISURF

306 PUNCHED-CARDS INPUT DECK  
REQUIRED FOR XQT TRWPLT  
(13 FIGURES)

FIGURE # 1, PLANFORM VIEW OF WING

FIGURE # 2, ISOMETRIC PROJECTION OF WING

FIGURE # 3, CHORDWISE PRESSURE DISTRIBUTION

# 6.1 INPUT-DATA LISTINGS (CONTINUED)

```

NOADV = 1
CADD = 0.4, 1.0
PLOT = 1.4, 2.4, ENDLST
ENDPLT
NOADV = 1
CADD = 0.6, 1.3
PLOT = 1.6, 2.6, ENDLST
ENDPLT
NOADV = 1
CADD = 0.8, 2.0
PLOT = 1.8, 2.8, ENDLST
ENDPLT
NOADV = 1
CADD = 1.0, 2.5
PLOT = 1.9, 2.9, ENDLST
ENDPLT
NOADV = 1
CADD = 1.2, 3.0
PLOT = 1.11, 2.11, ENDLST
ENDPLT
NOADV = 1
CADD = 1.4, 3.5
PLOT = 1.13, 2.13, ENDLST
ENDPLT
NOADV = 1
CADD = 1.6, 4.0
PLOT = 1.15, 2.15, ENDLST
ENDPLT
NOADV = 1
CADD = 1.8, 4.5
PLOT = 1.16, 2.16, ENDLST
ENDPLT

```

```

ENDFIL
TITLE = 10 = SPAN AIRLOAD DISTRIBUTION
XLABEL = 10 = HORIZONTAL DISTANCE, SEMISPANS
YLABEL = 10 = SECTION LIFT COEFFICIENT CL
CADD = 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0
XLO = -1.2
XHI = 1.2
YHI = 3.0
YLO = -1.0
PLOT = 1.1, 2.1, ENDLST
ENDPLT

```

```

YLABEL = 10 = SECTION INDUCED DRAG COEFFICIENT CDI
PLOT = 1.1, 3.1, ENDLST
ENDPLT
YLABEL = 10 = SECTION PITCHING MOMENT COEFFICIENT CMAC
YLO = -1.5
YHI = 1.0
PLOT = 1.1, 4.1, ENDLST
ENDPLT

```

```

ENDFIL
TITLE = 10 = LINEAR SOLUTION - SPAN AIRLOAD DISTRIBUTION
XLABEL = 10 = HORIZONTAL DISTANCE, SEMISPANS
YLABEL = 10 = SECTION LIFT COEFFICIENT CL
XLO = -1.2
XHI = 1.2
YLO = -1.5
YHI = 3.0
PLOT = 1.1, 2.1, ENDLST
ENDPLT

```

```

NOADV = 1
PLOT = 1.2, 2.2, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.3, 2.3, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.4, 2.4, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.5, 2.5, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.6, 2.6, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.7, 2.7, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.8, 2.8, ENDLST
ENDPLT

```

```

YLABEL = 10 = SECTION INDUCED DRAG COEFFICIENT CDI
PLOT = 1.1, 3.1, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.2, 3.2, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.3, 3.3, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.4, 3.4, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.5, 3.5, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.6, 3.6, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.7, 3.7, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.8, 3.8, ENDLST
ENDPLT

```

```

YLABEL = 10 = SECTION PITCHING MOMENT COEFFICIENT CMAC
YLO = -1.5
YHI = 1.0
PLOT = 1.1, 4.1, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.2, 4.2, ENDLST
ENDPLT

```

FIGURE # 4, SECTION LIFT COEFFICIENT

FIGURE # 5, SECTION INDUCED DRAG COEFFICIENT

FIGURE # 6, SECTION PITCHING MOMENT COEFFICIENT

FIGURE # 7, SECTION LIFT COEFFICIENT ARRAY  
(LINEAR SOLUTION)

FIGURE # 8, SECTION INDUCED DRAG COEFFICIENT ARRAY  
(LINEAR SOLUTION)

FIGURE # 9, SECTION PITCHING MOMENT COEFFICIENT ARRAY  
(LINEAR SOLUTION)

# 6.1 INPUT-DATA LISTINGS (CONTINUED)

```

NOADV = 1
PLOT = 1.3, 4.3, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.4, 4.4, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.5, 4.5, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.6, 4.6, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.7, 4.7, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.8, 4.8, ENDLST
ENDPLT

```

```

YLABEL= 10 = FLAP/AIL NORMAL FORCE COEFF CNF
YLO = -2.0
YHI = 4.0
PLOT = 1.1, 5.1, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.2, 5.2, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.3, 5.3, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.4, 5.4, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.5, 5.5, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.6, 5.6, ENDLST
ENDPLT

```

```

NOADV = 1
PLOT = 1.7, 5.7, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.8, 5.8, ENDLST
ENDPLT

```

```

YLABEL= 10 = FLAP/AIL HORIZ FORCE COEFF CXF
PLOT = 1.1, 6.1, ENDLST
ENDPLT

```

```

NOADV = 1
PLOT = 1.2, 6.2, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.3, 6.3, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.4, 6.4, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.5, 6.5, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.6, 6.6, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.7, 6.7, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.8, 6.8, ENDLST
ENDPLT

```

```

YLABEL= 10 = FLAP/AIL HINGE MOMENT COEFF CHF
YLO = -1.5
YHI = 1.0
PLOT = 1.1, 7.1, ENDLST
ENDPLT

```

```

NOADV = 1
PLOT = 1.2, 7.2, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.3, 7.3, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.4, 7.4, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.5, 7.5, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.6, 7.6, ENDLST
ENDPLT
NOADV = 1
PLOT = 1.7, 7.7, ENDLST
ENDPLT

```

```

NOADV = 1
PLOT = 1.8, 7.8, ENDLST
ENDPLT

```

```

YLABEL = 10 = WING AIRLOAD COEFFICIENTS
XLABEL = 10 = WING ANGLE OF ATTACK, ALFA
XLO = -15.0
XHI = 25.0
YLO = -1.0
YHI = 3.0
PLOT = 1.9, 2.9, 3.9, 4.9, ENDLST
ENDPLT
ENDFIL
ENDRUN

```

```

*EOF

```

FIGURE # 10, FLAP NORMAL FORCE SECTION COEFFICIENT ARRAY  
(LINEAR SOLUTION)

FIGURE # 11, FLAP CHORD FORCE SECTION COEFFICIENT ARRAY  
(LINEAR SOLUTION)

FIGURE # 12, FLAP HINGE MOMENT SECTION COEFFICIENT ARRAY  
(LINEAR SOLUTION)

FIGURE # 13, WING AIRLOAD COEFFICIENTS  
(LINEAR SOLUTION)

# 6.1 INPUT-DATA LISTINGS (CONTINUED)

## EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERODYNAMIC ANALYSIS .....

```

VZ RUN T54889,TRW,1003,3303A,1003,C,5,1      GOMEZ   TRW
VN MSG      FILE REQ. TAPE 1 FH432 3 FSTRN 1
V ASC X=10202
V ASC F
V PLT
V XQT CUR
  TRW X
  ERS
  REF X
  IN X

```

```

V XQT NSURF
EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERODYNAMIC ANALYSIS
TASK 722, PROJECT 3303A, MJD 147033, AERODYNAMIC ANALYSIS AND DESIGN
SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. H4010B (NSURF)
A.V.GOMEZ/ 5 JULY 1972

```

```

$INPUT
NHING=3,NVTAIL=-1, GSCALE=0.083333, COLOCP=0.80,
MIRNG=1,
NSS(1)=7,NCS(1)=2,NFLG(1)=22,NFLG(6)=6,XOC(1,1)=0.0,1.0,
X(1)=-50.5,-50.5,-50.5,-50.5,3.0,0.0,XOCR(1)=7.1,0,
Y(1)=0.0,57.27,114.54,171.81,229.08,400.89,629.97,
Z(1)=240.0,0.0,441.0,882.3,0.0,
E(1)=2.0,0.0,-0.5,-1.0,-1.5,-3.0,-3.0,
C(1)=1413.08,1261.518,1110.456,984.394,908.832,530.647,26.4,
MCANRO=1,
NSS(2)=9,NCS(2)=3,NFLG(2)=6,NFLG(7)=2,XOC(1,2)=0.0,0.5,1.0,
X(2)=-1723.0,-1723.0,XOCR(2)=0.59,0.31532,
Y(2)=0.0,171.81,
Z(2)=-73.0,-73.0,
E(2)=2.0,
C(2)=249.5,96.71,
ZOC(1,8)=0.0,0.0,0.0,0.08816,
ZOC(1,9)=0.0,0.0,0.0,0.08816,
MFUS=1,
NSS(3)=11,NCS(3)=2,NFLG(3)=2,NFLG(8)=3,XOC(1,3)=0.0,1.0,
X(10)=-1463.08,-1312.018,Y(10)=0.0,57.27,Z(10)=2.0,0.0,E(10)=2.0,0,
C(10)=740.0,640.0,XOCR(10)=1.0,1.0,XOC(1,3)=0.0,1.0,
MFINS=1,
NSS(4)=13,NCS(4)=2,NFLG(4)=3,NFLG(9)=2,XOC(1,4)=0.0,1.0,XOCR(12)=2.1,0,
X(12)=-50.5,36.0,Y(12)=2.171.81,Z(12)=0.882,-171.81,E(12)=-1.0,-1.0,
C(12)=328.1,313.83,07,
XCG=-725.9,ZCG=9.5,YCG=0.0,REFS=908883.0,REFC=942.38,REFB=1260.0,
NJOB=1,ALFA=10,MACHN=0.20,NSOLV=1.1,1.2,1.4,
KT2= 6, NFLG(19)= 1, 0,
$END
$ENDJOBS

```

36 PUNCHED-CARDS INPUT DECK  
 REQUIRED FOR XQT NSURF

```

V XQT TRWPLT
KUNIT = 4
ICCOMP= 0
NTRAN = 0
IPRINT= 0
NTYPE = 0
NOFSC= 1
ISCALY = 1.1,1.1,1.1,1.1,1.1,1.1
NXL = 24
NXR = 24
NYL = 24
NYH = 24
NPOSN1 = 600, 950
NPOSN2 = 600, 925
NPOSN3 = 600, 900
NPOSN4 = 600, 50
ANNO1 = 10 = EXAMPLE PROB, 3 - XB-70 AIRPLANE
ANNO2 = 10 = SUBSONIC AERODYNAMIC ANALYSIS
ANNO3 = 10 = A.GOMEZ/ 5 JULY 72
ANNO4 = 10 =
CHARS2 = 1.0,1.0,1.0,1.0
TITLE = 10 = ISOMETRIC PROJECTION OF LIFTING SURFACES
XLABEL = 10 = HORIZONTAL AXIS, SEMISPANS
YLABEL = 10 = VERTICAL AXIS, SEMISPANS
XHI= 2.0
XLO= -2.0
YHI= 2.0
YLO= -2.0
PLOT = 2.1, 3.1, ENDLST
ENDPLT
ANOTSV = 3
NOADV = 1
PLOT = 5.1, 6.1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2.2, 3.2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2.3, 3.3, ENDLST
ENDPLT
NOADV = 1
PLOT = 2.1, 3.1, ENDLST
ENDPLT
NOADV = 1
PLOT = 5.1, 6.1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2.2, 3.2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2.3, 3.3, ENDLST
ENDPLT
NOADV = 1
PLOT = 2.1, 3.1, ENDLST
ENDPLT
NOADV = 1
PLOT = 5.1, 6.1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2.2, 3.2, ENDLST
ENDPLT

```

108 PUNCHED-CARDS INPUT DECK  
 REQUIRED FOR XQT TRWPLT  
 (PLOT OPTION)

ORIGINAL PAGE IS  
 OF POOR QUALITY

# 6.1 INPUT-DATA LISTINGS (CONTINUED)

```

NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLOT
ENDFIL
NOADV = 1
PLOT = 2,1, 3,1, ENDLST
ENDPLOT
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLOT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLOT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLOT
ENDFIL
NOADV = 1
PLOT = 2,1, 3,1, ENDLST
ENDPLOT
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLOT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLOT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLOT
ENDFIL
NOADV = 1
PLOT = 2,1, 3,1, ENDLST
ENDPLOT
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLOT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLOT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLOT
ENDFIL
ENDRUN
VEOF

```

## EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC ANALYSIS

.....

```

VZ RUN T94589,TRW,1004,3303A,1004,C,2,1      GOMEZ TRW
VN MSG FILE REQ, TAPE 1 FH432 3 FSTRN 1
V ASG X=410202
V ASG F
V PLT
V XQT CUR
TRW X
ERS
PEF X
IN X

```

```

V XQT NSURF
EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC ANALYSIS
TASK 702, PROJECT 3303A, MJO 147033, AERODYNAMIC ANALYSIS AND DESIGN
SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. HA010B (NSURF)
A.V.GOMEZ/ 5 JULY 1972

```

```

$INPUT
NWIN=3, NVTAIL=0, NFUS=0, COLOCP=0.75,
NFLG(1)=3*10, NFLG(6)=3*5, NFLG(19)=1.2,
NCS=2*10,2, NSS=2,4,6,
THICKW= 1,
XOC(1,1)=.00,.05,.10,.15,.20,.30,.40,.60,.80,1.0,
XOC(1,2)=.00,.05,.10,.15,.20,.30,.40,.60,.80,1.0,
ZOC(1,1)=.0,.34443,.05853,.06682,.07172,.07502,.07254,.05704,.03279,.0,
ZOC(1,2)=.0,.34443,.05853,.06682,.07172,.07502,.07254,.05704,.03279,.0,
ZOC(1,3)=.0,.04443,-.05853,-.06682,-.07172,-.07502,-.07254,-.05704,-.03279,.0,
ZOC(1,4)=.0,-.04443,-.05853,-.06682,-.07172,-.07502,-.07254,-.05704,-.03279,.0,
X = 0.0, 0.0,
Y = 0.10, 0.10,
Z = 0.0, 0.0,
C = 10,10, 10,10,
E = 0.0, 0.0,
Z = 0.0, 0.0,
FLATP= 1,
XOC(1,3)=.00,1.0,
ZOC(1,5)=.0,.0,
ZOC(1,6)=.0,.0,
X(5)= 0.0,
Y(5)= 0.10,
Z(5)= 0.0,
C(5)= 10,10,
E(5)= 0.0,
XCP=0.0, REFC=10.0, REFB=20.0, REFS=200.0,
NJOB=1, ALFA=10, MACHN=0.0, NSOLV=1,2,3,3
SEND
SENDJOBS
V XQT TRWPLT
KUNIT = 8
ICCOMP = 0
NTRAN = 0
IPRINT = 0
NTYPE = 0
NOFSCL = 1
ISCALY = 1.1,1.1,1.1,1.1,1.1,1.1
NXL = 24
NXR = 24
NYL = 24
NYH = 24
NPOSN1 = 600, 950

```

35 PUNCHED-CARDS INPUT DECK  
REQUIRED FOR XQT NSURF

82 PUNCHED-CARDS INPUT DECK  
REQUIRED FOR XQT TRWPLT  
(PLOT OPTION)

# 6.1 INPUT-DATA LISTINGS (CONTINUED)

```

NPOSN2 = 600, 923
NPOSN3 = 600, 900
NPOSN4 = 600, 90
CHARSZ = 1.0, 1.0, 1.0, 1.0
ANNOY2 = 10 * SUBSONIC AERODYNAMIC ANALYSIS
ANNOY2 = 10 * SUBSONIC AERODYNAMIC ANALYSIS
ANNOY3 = 10 * A.GOMEZ/ 5 JULY 72
ANNOY4 = 10 *
CHARSZ = 1.0,1.0,1.0,1.0
TITLE = 10 * ISOMETRIC PROJECTION OF LIFTING SURFACES
XLABEL = 10 * HORIZONTAL AXIS, SEMISPANS
YLABEL = 10 * VERTICAL AXIS, SEMISPANS
XLO = -1.0
XHI = 2.0
YLO = -1.0
YHI = 2.0
XLO=-2.0
XHI= 3.0
YLO=-2.0
YHI= 3.0
PLOT = 2,1, 3,1, ENDLST
ENDPLT
ANDTSV = 0
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
NOADV = 1
PLOT = 2,1, 3,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 5,1, 6,1, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,2, 3,2, ENDLST
ENDPLT
NOADV = 1
PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
ENDRUN
7EOF

```

EXAMPLE PROBLEM NO. 5 - DEBUG-PRINT OUTPUT OPTIONS DEMONSTRATION  
\*\*\*\*\*

```

07 RUN T54589,TRW,1005,3303A,1005,C,1,1          GOMEZ TRW
0N MSG      FILE REQ.  TAPE 1  PH432 3  PSTR4 0
0 ASC X*#10202
0 XQT CUR
  TRW X
  ERS
  IN X
  TRI X
0 XQT NSURF
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 0
TASK 702, PROJECT 3303A, MJD 147033, AERODYNAMIC ANALYSIS AND DESIGN
SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. HAD10B (NSURF)
A.V.GOMEZ/ 5 JULY 1972

$INPUT
NHING=1,
NCS(1)=2, NCS(1)=2, NFLG(1)=3, NFLG(6)=2, NFLG(11)=1,
X(1)=2*0., Y(1)=0.,10., Z(1)=2*0., E(1)=2*0., C(1)=2*10., XOCR(1)=2*0.25,
XOC(1)=0.,1., FLAPDJ(1)= 10., NJOB=1, ALFA= 5, MACHN= 0., NSOLV=1,1,
NFLG(20)= 0,
$END
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 1
$INPUT
NFLG(20)= 1,
$END
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 2
$INPUT
NFLG(20)= 2,
$END
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 5
$INPUT
NFLG(20)= 5,
$END
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 8
$INPUT
NFLG(20)= 8,
$END
EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 16
$INPUT
NFLG(20)= 16, NFLG(17)=1,
$END
$ENDJOBS
0 XQT NSURFT
0 XQT ISURFT
7EOF

```

33 PUNCHED-CARDS INPUT DECK  
REQUIRED FOR XQT NSURF

ORIGINAL PAGE IS  
OF POOR QUALITY



## 6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY

SUBSONIC-FLUX LIFTING SURFACE ANALYSIS PROGRAM HAO10B

TRW SYSTEMS INC., HOUSTON OPERATIONS

HOUSTON, TEXAS (77058)

\*\*\*\* JOBS INPUT LIST \*\*\*\*

7 XQT NSURF

EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION  
 TASK 702, PROJECT 3303A, MJO 14703, AERODYNAMIC ANALYSIS AND DESIGN  
 SUBSONIC-FLUX LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. HAO10B (NSURF)  
 A.V. GOMEZ / 5 JULY 1972

```

$INPUT
NWIN=2, NFUS=1, NVTAIL=-2,
MNING=1,
NCS(1)=3, NCS(2)=2, NFG(1)=28, NFG(2)=4, NFG(3)=1,
X(1)=3*30., Y(1)=0.,40.,140., Z(1)=2*0.,-17.053, E(1)=2*4.,-1., XOCR(1)=3*1.,
C(1)=2*40.,10., XOC(1)=0.,1., FLAPC(1)=2*0.30, TABC(1)=3*0.08,
FLAPDJ(1)=40., AILDJ(1)=20.,15., WFLAP(1)=0.,WFLAP2(1)=40.,WFLAP3(1)=140.,
MHTAIL=1,
NCS(2)=5, NCS(3)=2, NFG(2)=8, NFG(3)=3, NFG(4)=1,
X(4)=2*150., Y(4)=0.,40., Z(4)=2*20., E(4)=2*2., XOCR(4)=2*1., C(4)=30.,20.,
XOC(4)=0.,1., FLAPC(4)=2*10., TABC(4)=2*0.5,
FLAPDJ(2)=30., WFLAP(2)=0.,WFLAP2(2)=40.,WFLAP3(2)=40.,
NFUSEL=1,
NCS(3)=7, NCS(4)=2, NFG(3)=2, NFG(4)=4,
X(6)=2*50., Y(6)=2*0., Z(6)=0.,-20., E(6)=2*0., XOCR(6)=2*0., C(6)=80.,200.,
XOC(6)=0.,1.,
MVTAIL=1,
NCS(4)=9, NCS(5)=2, NFG(4)=3, NFG(5)=4, NFG(6)=1,
X(8)=2*150., Y(8)=2*40., Z(8)=10.,-40., E(8)=2*0., XOCR(8)=2*1.,
C(8)=25.,10., XOC(8)=0.,1., FLAPC(8)=2*0.5, TABC(8)=2*0.10,
FLAPDJ(4)=30., WFLAP(4)=0.,WFLAP2(4)=30.,WFLAP3(4)=30.,
NACELE=1,
NCS(5)=12, NCS(6)=2, NFG(5)=2, NFG(6)=0,
X(10)=3*30., Y(10)=3*40., Z(10)=10.,-10., E(10)=3*0., XOCR(10)=3*0.,
C(10)=30.,2*60., XOC(10)=0.,1.,
XCG=0., REFC=32.681, REFB=280.0, REFD=8200.0,
KT2=8, NFG(19)=1, NJOB=1, ALFA=10., MACHN=3.2, NSOLV=12*0,
$END
EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION
$INPUT
NWIN=2, NFUS=0, NVTAIL=0, NFG(19)=0, NSOLV=1,1,1,2, FLAPDJ=30.,-10.,
NFG(1)=14,4,
$END
$ENDJOBS
7 XQT NSURF

```

DASHED LINE INDICATES NEW PAGE

JOBSFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
 VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 1

```

$INPUT
KOUT = +6,
KT1 = +1,
KT2 = +8,
KT3 = +3,
LINK = +50,
NWIN = +2,
NVTAIL = -2,
NFUS = +1,
COLOCP = .75000000E+00,
CUTOFF1 = .10000000E-03,
CUTOFF2 = .29000000E-02,
LFLAP = +0,
GSCALE = .10000000E+01,
NSS = +3,
NCS = +12,
X = +2,
Y = +2,
Z = +2,
E = +2,
C = +2,

```

ORIGINAL PAGE IS  
OF POOR QUALITY

ORIGINAL PAGE IS  
OF POOR QUALITY.

ORIGINAL PAGE IS  
OF POOR QUALITY.

```

.30000000E+01, .30000000E+01, .12500000E+00, .12500000E+00,
.10000000E+00, .10000000E+00, .12500000E+00, .12500000E+00,
.12500000E+00, .12500000E+00, .12500000E+00, .12500000E+00,
.12500000E+00, .12500000E+00, .12500000E+00, .12500000E+00,
.12500000E+00, .12500000E+00, .12500000E+00, .12500000E+00,
.12500000E+00, .12500000E+00, .12500000E+00, .12500000E+00,
WSMOTH = .10000000E+00,
XCG = .00000000E+00,
YCG = .00000000E+00,
ZCG = .00000000E+00,
REFS = .82000000E+04,
REFC = .32681300E+02,
REFB = .28000000E+03,
NJOB = .1,
ALFA = .10000000E+02, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
MACHN = .20000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
HEIGHT = .10000000E+05, .10000000E+05, .10000000E+05, .10000000E+05,
.10000000E+05, .10000000E+05, .10000000E+05, .10000000E+05,
.10000000E+05, .10000000E+05, .10000000E+05, .10000000E+05,
.10000000E+05, .10000000E+05, .10000000E+05, .10000000E+05,
FLAPDJ = .40000000E+02, .30000000E+02, .30000000E+02, .30000000E+02,
.30000000E+02, .30000000E+02, .30000000E+02, .30000000E+02,
.30000000E+02, .30000000E+02, .30000000E+02, .30000000E+02,
.30000000E+02, .30000000E+02, .30000000E+02, .30000000E+02,
TABDJ = .00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
ALUDJ = -.20000000E+02, .15000000E+02, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
.00000000E+00, .00000000E+00, .00000000E+00, .00000000E+00,
NFLG = +28, +0, +2,
+2, +4, +4, +4,
+4, +6, +6, +6,
+0, +1, +1, +1,
+0, +0, +0, +0,
NSOLV = +0, +0, +0, +0,
+0, +0, +0, +0,
SEND

```

```

JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20  EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP  PAGE
VALUE    28  8  2  3  2  4  3  4  4  0  1  1  0  1  0  0  0  1  1  4  ALFA= .00 MACHNO= .0000 ALTITUDE=*****  2

```

LIFTING SURFACE NO= 1  
\*\*\*\*\*

- SURFACE # 1 = WING

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAG)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
289.000	40.000	10.000	4.0000	-1.0000	8199.59	9.5615	29.284	32.681	56.591	5.489	-5.655
FLAP SPAN1 .000	FLAP SPAN2 40.000	FLAP SPAN3 140.000	FLAP DEFLEC 40.000	TAB DEFLEC .000	L.AIL OFFLEC -20.000	R.AIL DEFLEC 15.000	DIHED. MGC/4 10.000	SWEEP MGC/4 12.494	NO.SPAN ELEMENTS 28	NO.CHORD ELEMENTS 4	NO.CHORD DISCONT. 1.
			FW STA X(CG) .000	WING STA Y(CG) .000	HL STA Z(CG) .000	AREA S(CG) 8200.000	CHORD C(CG) 32.681	SPAN B(CG) 280.000			

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-141.543	-140.000	-17.633	20.000	22.500	30.000	-1.000	-10.000	-12.494	10.000	3.000	1.800
-127.388	126.061	-15.175	11.000	14.364	30.000	-3.303	-10.000	-12.494	14.182	4.255	1.355
-113.234	112.122	-12.717	11.000	16.227	30.000	.394	-10.000	-12.494	18.364	5.509	1.469
-99.080	-98.182	-10.259	7.000	13.091	30.000	1.091	-10.000	-12.494	22.545	6.764	1.894
-84.926	-84.243	-7.801	3.000	4.955	30.000	1.788	-10.000	-12.494	26.727	8.018	2.138
-70.771	-70.304	-5.343	-.000	0.818	30.000	2.485	-10.000	-12.494	30.905	9.273	2.473
-56.617	-56.365	-2.886	-3.000	3.882	30.000	3.182	-10.000	-12.494	35.091	10.527	2.807
-42.463	-42.425	-.428	-4.000	.546	30.000	3.879	-10.000	-12.494	39.272	11.782	3.142
-28.309	-28.309	.000	-10.000	.000	30.000	4.000	.000	.000	40.000	12.000	3.200
-14.154	-14.154	.000	-10.000	.000	30.000	4.000	.000	.000	40.000	12.000	3.200
.000	.000	.000	-10.000	.000	30.000	4.000	.000	.000	40.000	12.000	3.200
14.154	14.154	.000	-10.000	.000	30.000	4.000	.000	.000	40.000	12.000	3.200
28.309	28.309	.000	-10.000	.000	30.000	4.000	.000	.000	40.000	12.000	3.200
42.463	42.425	-.428	-4.000	.546	30.000	3.879	10.000	12.494	39.272	11.782	3.142
56.617	56.365	-2.886	-3.000	3.882	30.000	3.182	10.000	12.494	35.091	10.527	2.807
70.771	70.304	-5.343	-.000	0.818	30.000	2.485	10.000	12.494	30.905	9.273	2.473
84.926	84.243	-7.801	3.000	4.955	30.000	1.788	10.000	12.494	26.727	8.018	2.138
99.080	98.182	-10.259	7.000	13.091	30.000	1.091	10.000	12.494	22.545	6.764	1.894
113.234	112.122	-12.717	11.000	16.227	30.000	.394	10.000	12.494	18.364	5.509	1.469
127.388	126.061	-15.175	11.000	14.364	30.000	-3.303	10.000	12.494	14.182	4.255	1.355
141.543	140.000	-17.633	20.000	22.500	30.000	-1.000	10.000	12.494	10.000	3.000	1.800

```

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20  EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS GAP PAGE
VALUE 28 8 2 3 2 4 3 4 4 8 1 1 0 1 1 0 0 1 1 4  ALFA= .00 MACHNO=.0000 ALTITUDE=***** 3

```

[illegible]

## 6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

J	K	Y	Z	WL	EW	DWL	DC	DS
1	1	-1.350+02	-1.664+01	1.365+02	1.264+02	1.711+01	2.333+00	2.711+01
2	1	-1.251+02	-1.495+01	1.264+02	1.264+02	1.711+01	3.030+00	3.416+01
3	1	-1.151+02	-1.331+01	1.163+02	1.163+02	1.711+01	3.727+00	4.121+01
4	1	-1.052+02	-1.171+01	1.062+02	1.062+02	1.711+01	4.424+00	4.825+01
5	1	-9.520+01	-1.004+01	9.605+01	9.605+01	1.711+01	5.121+00	5.530+01
6	1	-8.524+01	-8.644+00	8.594+01	8.594+01	1.711+01	5.818+00	6.235+01
7	1	-7.528+01	-7.174+00	7.583+01	7.583+01	1.711+01	6.515+00	6.939+01
8	1	-6.533+01	-5.747+00	6.572+01	6.572+01	1.711+01	7.212+00	7.644+01
9	1	-5.537+01	-4.364+00	5.561+01	5.561+01	1.711+01	7.909+00	8.348+01
10	1	-4.541+01	-3.023+00	4.550+01	4.550+01	1.711+01	8.606+00	9.053+01
11	1	-3.538+01	-2.336+00	3.539+01	3.539+01	1.711+01	9.303+00	9.421+01
12	1	-2.528+01	-2.378+00	2.528+01	2.528+01	1.711+01	9.333+00	9.436+01
13	1	-1.517+01	-2.378+00	1.517+01	1.517+01	1.711+01	9.333+00	9.436+01
14	1	-5.055+00	-2.378+00	5.055+00	5.055+00	1.711+01	9.333+00	9.436+01
15	1	5.055+00	-2.378+00	5.055+00	5.055+00	1.711+01	9.333+00	9.436+01
16	1	1.517+01	-2.378+00	1.517+01	1.517+01	1.711+01	9.333+00	9.436+01
17	1	2.528+01	-2.378+00	2.528+01	2.528+01	1.711+01	9.333+00	9.436+01
18	1	3.538+01	-2.378+00	3.539+01	3.539+01	1.711+01	9.333+00	9.421+01
19	1	4.541+01	-3.023+00	4.550+01	4.550+01	1.711+01	9.303+00	9.053+01
20	1	5.537+01	-4.364+00	5.561+01	5.561+01	1.711+01	8.606+00	8.348+01
21	1	6.533+01	-5.747+00	6.572+01	6.572+01	1.711+01	7.909+00	7.644+01
22	1	7.528+01	-7.174+00	7.583+01	7.583+01	1.711+01	7.212+00	6.939+01
23	1	8.524+01	-8.644+00	8.594+01	8.594+01	1.711+01	6.515+00	6.235+01
24	1	9.520+01	-1.004+01	9.605+01	9.605+01	1.711+01	5.818+00	5.530+01
25	1	1.052+02	-1.171+01	1.062+02	1.062+02	1.711+01	5.121+00	4.825+01
26	1	1.151+02	-1.331+01	1.163+02	1.163+02	1.711+01	4.424+00	4.121+01
27	1	1.251+02	-1.495+01	1.264+02	1.264+02	1.711+01	3.727+00	3.416+01
28	1	1.350+02	-1.664+01	1.365+02	1.365+02	1.711+01	3.030+00	2.711+01
1	2	-1.350+02	-1.667+01	1.365+02	1.365+02	1.711+01	2.333+00	2.711+01
2	2	-1.251+02	-1.497+01	1.264+02	1.264+02	1.711+01	3.030+00	3.416+01
3	2	-1.151+02	-1.329+01	1.163+02	1.163+02	1.711+01	3.727+00	4.121+01
4	2	-1.052+02	-1.165+01	1.062+02	1.062+02	1.711+01	4.424+00	4.825+01
5	2	-9.520+01	-1.004+01	9.605+01	9.605+01	1.711+01	5.121+00	5.530+01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
 VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 4

J	K	Y	Z	WL	EW	DWL	DC	DS
6	2	-8.524+01	-8.455+00	8.594+01	8.594+01	1.711+01	5.818+00	6.235+01
7	2	-7.528+01	-6.905+00	7.583+01	7.583+01	1.711+01	6.515+00	6.939+01
8	2	-6.533+01	-5.385+00	6.572+01	6.572+01	1.711+01	7.212+00	7.644+01
9	2	-5.537+01	-3.864+00	5.561+01	5.561+01	1.711+01	7.909+00	8.348+01
10	2	-4.541+01	-2.438+00	4.550+01	4.550+01	1.711+01	8.606+00	9.053+01
11	2	-3.538+01	-1.686+00	3.539+01	3.539+01	1.711+01	9.303+00	9.421+01
12	2	-2.528+01	-1.655+00	2.528+01	2.528+01	1.711+01	9.333+00	9.436+01
13	2	-1.517+01	-1.655+00	1.517+01	1.517+01	1.711+01	9.333+00	9.436+01
14	2	-5.055+00	-1.655+00	5.055+00	5.055+00	1.711+01	9.333+00	9.436+01
15	2	5.055+00	-1.655+00	5.055+00	5.055+00	1.711+01	9.333+00	9.436+01
16	2	1.517+01	-1.655+00	1.517+01	1.517+01	1.711+01	9.333+00	9.436+01
17	2	2.528+01	-1.655+00	2.528+01	2.528+01	1.711+01	9.333+00	9.436+01
18	2	3.538+01	-1.686+00	3.539+01	3.539+01	1.711+01	9.333+00	9.421+01
19	2	4.541+01	-2.438+00	4.550+01	4.550+01	1.711+01	9.303+00	9.053+01
20	2	5.537+01	-3.864+00	5.561+01	5.561+01	1.711+01	8.606+00	8.348+01
21	2	6.533+01	-5.385+00	6.572+01	6.572+01	1.711+01	7.909+00	7.644+01
22	2	7.528+01	-6.905+00	7.583+01	7.583+01	1.711+01	7.212+00	6.939+01
23	2	8.524+01	-8.455+00	8.594+01	8.594+01	1.711+01	6.515+00	6.235+01
24	2	9.520+01	-1.004+01	9.605+01	9.605+01	1.711+01	5.818+00	5.530+01
25	2	1.052+02	-1.165+01	1.062+02	1.062+02	1.711+01	5.121+00	4.825+01
26	2	1.151+02	-1.329+01	1.163+02	1.163+02	1.711+01	4.424+00	4.121+01
27	2	1.251+02	-1.497+01	1.264+02	1.264+02	1.711+01	3.727+00	3.416+01
28	2	1.350+02	-1.667+01	1.365+02	1.365+02	1.711+01	3.030+00	2.711+01
1	3	-1.350+02	-1.670+01	1.365+02	1.365+02	1.711+01	2.333+00	2.711+01
2	3	-1.251+02	-1.458+01	1.264+02	1.264+02	1.711+01	3.030+00	3.416+01
3	3	-1.151+02	-1.327+01	1.163+02	1.163+02	1.711+01	3.727+00	4.121+01
4	3	-1.052+02	-1.159+01	1.062+02	1.062+02	1.711+01	4.424+00	4.825+01
5	3	-9.520+01	-9.517+00	9.605+01	9.605+01	1.711+01	5.121+00	5.530+01
6	3	-8.524+01	-8.267+00	8.594+01	8.594+01	1.711+01	5.818+00	6.235+01
7	3	-7.528+01	-6.635+00	7.583+01	7.583+01	1.711+01	6.515+00	6.939+01
8	3	-6.533+01	-5.022+00	6.572+01	6.572+01	1.711+01	7.212+00	7.644+01
9	3	-5.537+01	-3.428+00	5.561+01	5.561+01	1.711+01	7.909+00	8.348+01
10	3	-4.541+01	-1.853+00	4.550+01	4.550+01	1.711+01	8.606+00	9.053+01
11	3	-3.538+01	-1.036+00	3.539+01	3.539+01	1.711+01	9.303+00	9.421+01
12	3	-2.528+01	-1.002+00	2.528+01	2.528+01	1.711+01	9.333+00	9.436+01
13	3	-1.517+01	-1.002+00	1.517+01	1.517+01	1.711+01	9.333+00	9.436+01
14	3	-5.055+00	-1.002+00	5.055+00	5.055+00	1.711+01	9.333+00	9.436+01
15	3	5.055+00	-1.002+00	5.055+00	5.055+00	1.711+01	9.333+00	9.436+01
16	3	1.517+01	-1.002+00	1.517+01	1.517+01	1.711+01	9.333+00	9.436+01
17	3	2.528+01	-1.002+00	2.528+01	2.528+01	1.711+01	9.333+00	9.436+01
18	3	3.538+01	-1.036+00	3.539+01	3.539+01	1.711+01	9.333+00	9.421+01
19	3	4.541+01	-1.853+00	4.550+01	4.550+01	1.711+01	9.303+00	9.053+01
20	3	5.537+01	-3.428+00	5.561+01	5.561+01	1.711+01	8.606+00	8.348+01
21	3	6.533+01	-5.022+00	6.572+01	6.572+01	1.711+01	7.909+00	7.644+01
22	3	7.528+01	-6.635+00	7.583+01	7.583+01	1.711+01	7.212+00	6.939+01
23	3	8.524+01	-8.267+00	8.594+01	8.594+01	1.711+01	6.515+00	6.235+01
24	3	9.520+01	-9.517+00	9.605+01	9.605+01	1.711+01	5.818+00	5.530+01
25	3	1.052+02	-1.151+01	1.062+02	1.062+02	1.711+01	5.121+00	4.825+01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
 VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 5

J	K	Y	Z	WL	EW	DWL	DC	DS
26	3	1.151+02	-1.327+01	1.163+02	1.163+02	1.711+01	4.424+00	4.121+01
27	3	1.251+02	-1.458+01	1.264+02	1.264+02	1.711+01	3.727+00	3.416+01
28	3	1.350+02	-1.670+01	1.365+02	1.365+02	1.711+01	3.030+00	2.711+01
1	4	-1.350+02	-1.674+01	1.365+02	1.365+02	1.711+01	3.030+00	3.486+01
2	4	-1.251+02	-1.570+01	1.264+02	1.264+02	1.711+01	3.896+00	4.392+01
3	4	-1.151+02	-1.325+01	1.163+02	1.163+02	1.711+01	4.792+00	5.298+01
4	4	-1.052+02	-1.151+01	1.062+02	1.062+02	1.711+01	5.688+00	6.204+01

## 6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

5	4	-4.520+01	-9.771+00	9.605+01	9.605+01	1.011+01	6.584+00	7.110+01
6	4	-8.524+01	-8.038+00	8.594+01	8.594+01	1.011+01	7.480+00	8.016+01
7	4	-7.528+01	-6.308+00	7.583+01	7.583+01	1.011+01	8.377+00	8.922+01
8	4	-6.533+01	-2.862+00	6.572+01	6.572+01	1.011+01	9.273+00	9.828+01
9	4	-5.537+01	-2.860+00	5.561+01	5.561+01	1.011+01	1.017+01	1.773+02
10	4	-4.541+01	-1.142+00	4.550+01	4.550+01	1.011+01	1.106+01	1.164+02
11	4	-3.538+01	-2.471+01	3.539+01	3.539+01	1.011+01	1.196+01	1.211+02
12	4	-2.528+01	-2.471+01	2.528+01	2.528+01	1.011+01	1.200+01	1.213+02
13	4	-1.517+01	-2.471+01	1.517+01	1.517+01	1.011+01	1.200+01	1.213+02
14	4	-5.755+00	-2.471+01	5.755+00	5.755+00	1.011+01	1.200+01	1.213+02
15	4	5.755+00	-2.471+01	5.755+00	5.755+00	1.011+01	1.200+01	1.213+02
16	4	1.517+01	-2.471+01	1.517+01	1.517+01	1.011+01	1.200+01	1.213+02
17	4	2.528+01	-2.471+01	2.528+01	2.528+01	1.011+01	1.200+01	1.213+02
18	4	3.538+01	-2.471+01	3.539+01	3.539+01	1.011+01	1.200+01	1.211+02
19	4	4.541+01	-1.142+00	4.550+01	4.550+01	1.011+01	1.196+01	1.164+02
20	4	5.537+01	-2.860+00	5.561+01	5.561+01	1.011+01	1.106+01	1.073+02
21	4	6.533+01	-8.582+00	6.572+01	6.572+01	1.011+01	1.017+01	9.828+01
22	4	7.528+01	-6.308+00	7.583+01	7.583+01	1.011+01	9.273+00	8.922+01
23	4	8.524+01	-8.038+00	8.594+01	8.594+01	1.011+01	8.377+00	8.016+01
24	4	9.520+01	-9.771+00	9.605+01	9.605+01	1.011+01	7.480+00	7.110+01
25	4	1.052+02	-1.151+01	1.062+02	1.062+02	1.011+01	6.584+00	6.204+01
26	4	1.151+02	-1.151+01	1.163+02	1.163+02	1.011+01	5.688+00	5.298+01
27	4	1.251+02	-1.151+01	1.264+02	1.264+02	1.011+01	4.792+00	4.392+01
28	4	1.350+02	-1.151+01	1.365+02	1.365+02	1.011+01	3.896+00	3.486+01

J	K	XV	YV	ZV	IXV	IYV	IZV	XN	YN	ZN	IXN	IYN	IZN
1	1	2.756+01	-1.400+02	-1.747+01	-2.083+01	9.496+01	1.620+01	2.052+01	-1.350+02	-1.667+01	1.237+02	-1.647+01	9.863+01
2	1	1.777+01	-1.300+02	-1.577+01	-2.083+01	9.503+01	1.575+01	1.805+01	-1.251+02	-1.495+01	3.919+03	-1.624+01	9.867+01
3	1	1.496+01	-1.201+02	-1.412+01	-2.083+01	9.510+01	1.529+01	1.559+01	-1.151+02	-1.331+01	4.580+03	-1.600+01	9.871+01
4	1	1.215+01	-1.101+02	-1.252+01	-2.083+01	9.517+01	1.483+01	1.313+01	-1.052+02	-1.171+01	5.111+03	-1.576+01	9.874+01
5	1	9.332+00	-1.002+02	-1.097+01	-2.083+01	9.523+01	1.437+01	1.066+01	-9.520+01	-1.016+01	5.688+03	-1.552+01	9.876+01
6	1	6.520+00	-9.022+01	-9.465+00	-2.083+01	9.530+01	1.392+01	8.197+00	-8.524+01	-8.644+00	3.019+02	-1.528+01	9.878+01
7	1	3.707+00	-8.026+01	-8.011+00	-2.083+01	9.536+01	1.345+01	7.528+01	-7.528+01	-7.174+00	3.879+02	-1.503+01	9.879+01
8	1	8.942+01	-7.030+01	-6.807+00	-2.083+01	9.542+01	1.299+01	3.268+00	-6.533+01	-5.747+00	4.737+02	-1.479+01	9.879+01
9	1	-1.919+00	-6.035+01	-5.251+00	-2.083+01	9.548+01	1.253+01	8.038+01	-5.537+01	-4.364+00	5.595+02	-1.454+01	9.878+01
10	1	-4.731+00	-5.039+01	-3.945+00	-2.083+01	9.553+01	1.206+01	1.660+00	-4.541+01	-3.023+00	6.454+02	-1.429+01	9.876+01
11	1	-7.544+00	-4.043+01	-2.888+00	-2.083+01	9.559+01	1.159+01	2.320+01	-3.538+01	-2.336+00	6.957+02	-1.404+01	9.876+01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
 VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO=.0000 ALTITUDE=\*\*\*\*\* 6

J	K	XV	YV	ZV	IXV	IYV	IZV	XN	YN	ZN	IXN	IYN	IZN
12	1	-7.667+00	-3.033+01	-2.634+00	0.000	1.000+00	0.000	-3.000+00	-2.528+01	-2.308+00	-6.976+02	0.000	9.976+01
13	1	-7.667+00	-2.022+01	-2.634+00	0.000	1.000+00	0.000	-3.000+00	-1.517+01	-2.308+00	-6.976+02	0.000	9.976+01
14	1	-7.667+00	-1.011+01	-2.634+00	0.000	1.000+00	0.000	-3.000+00	-5.055+00	-2.308+00	-6.976+02	0.000	9.976+01
15	1	-7.667+00	1.907+00	-2.634+00	0.000	1.000+00	0.000	-3.000+00	5.055+00	-2.308+00	-6.976+02	0.000	9.976+01
16	1	-7.667+00	1.011+01	-2.634+00	0.000	1.000+00	0.000	-3.000+00	1.517+01	-2.308+00	-6.976+02	0.000	9.976+01
17	1	-7.667+00	2.022+01	-2.634+00	0.000	1.000+00	0.000	-3.000+00	2.528+01	-2.308+00	-6.976+02	0.000	9.976+01
18	1	-7.667+00	3.033+01	-2.634+00	1.011+02	9.999+01	-5.312+03	-2.946+00	3.538+01	-2.336+00	-6.957+02	6.144+03	9.976+01
19	1	-7.544+00	4.043+01	-2.888+00	2.083+01	9.553+01	-1.206+01	-1.660+00	4.541+01	-3.023+00	-6.454+02	1.429+01	9.876+01
20	1	-4.731+00	5.039+01	-3.945+00	2.083+01	9.548+01	-1.253+01	8.038+01	5.537+01	-4.364+00	5.595+02	1.454+01	9.878+01
21	1	-1.919+00	6.035+01	-5.251+00	2.083+01	9.542+01	-1.299+01	3.268+00	6.533+01	-5.747+00	4.737+02	1.479+01	9.879+01
22	1	8.942+01	7.030+01	-6.807+00	2.083+01	9.536+01	-1.345+01	5.732+00	7.528+01	-7.174+00	3.879+02	1.503+01	9.879+01
23	1	3.707+00	8.026+01	-8.011+00	2.083+01	9.530+01	-1.392+01	8.197+00	8.524+01	-8.644+00	3.022+02	1.528+01	9.878+01
24	1	6.520+00	9.022+01	-9.465+00	2.083+01	9.523+01	-1.437+01	6.666+01	9.520+01	-1.016+01	-2.166+02	1.552+01	9.876+01
25	1	9.332+00	1.002+02	-1.097+01	2.083+01	9.517+01	-1.483+01	1.313+01	1.052+02	-1.171+01	-1.311+02	1.576+01	9.874+01
26	1	1.215+01	1.101+02	-1.252+01	2.083+01	9.510+01	-1.529+01	1.559+01	1.151+02	-1.331+01	-4.580+03	1.600+01	9.871+01
27	1	1.496+01	1.201+02	-1.412+01	2.083+01	9.503+01	-1.575+01	1.805+01	1.251+02	-1.495+01	3.919+03	1.624+01	9.867+01
28	1	1.777+01	1.300+02	-1.577+01	2.083+01	9.496+01	-1.620+01	2.052+01	1.350+02	-1.667+01	1.237+02	1.647+01	9.863+01

1	2	2.292+01	-1.400+02	-1.751+01	-2.083+01	9.646+01	1.659+01	2.320+01	-1.350+02	-1.667+01	1.237+02	-1.670+01	9.859+01
2	2	2.780+01	-1.300+02	-1.580+01	-2.083+01	9.652+01	1.625+01	2.143+01	-1.251+02	-1.497+01	3.918+03	-1.652+01	9.863+01
3	2	1.869+01	-1.201+02	-1.412+01	-2.083+01	9.657+01	1.590+01	1.907+01	-1.151+02	-1.329+01	4.578+03	-1.634+01	9.866+01
4	2	1.657+01	-1.101+02	-1.248+01	-2.083+01	9.663+01	1.555+01	1.790+01	-1.052+02	-1.165+01	5.111+03	-1.610+01	9.868+01
5	2	1.445+01	-1.002+02	-1.088+01	-2.083+01	9.668+01	1.523+01	1.613+01	-9.520+01	-1.004+01	5.688+03	-1.598+01	9.869+01
6	2	1.234+01	-9.022+01	-9.314+00	-2.083+01	9.673+01	1.485+01	1.436+01	-8.524+01	-8.455+00	3.019+02	-1.579+01	9.870+01
7	2	1.022+01	-8.026+01	-7.785+00	-2.083+01	9.678+01	1.450+01	1.260+01	-7.528+01	-7.174+00	3.879+02	-1.561+01	9.870+01
8	2	8.106+00	-7.030+01	-6.294+00	-2.083+01	9.683+01	1.415+01	1.083+01	-6.533+01	-5.747+00	4.732+02	-1.542+01	9.869+01
9	2	5.990+00	-6.035+01	-4.839+00	-2.083+01	9.688+01	1.379+01	9.761+00	-5.537+01	-3.896+00	5.589+02	-1.524+01	9.867+01
10	2	3.875+00	-5.039+01	-3.421+00	-2.083+01	9.693+01	1.344+01	7.294+00	-4.541+01	-3.023+00	6.447+02	-1.505+01	9.865+01
11	2	1.759+00	-4.043+01	-2.841+00	-2.083+01	9.699+01	1.307+01	6.333+00	-3.538+01	-2.336+00	6.957+02	-1.480+01	9.976+01
12	2	1.667+00	-3.033+01	-1.981+00	0.000	1.000+00	0.000	6.333+00	-2.528+01	-1.655+00	-6.976+02	0.000	9.976+01
13	2	1.667+00	-2.022+01	-1.981+00	0.000	1.000+00	0.000	6.333+00	-1.517+01	-1.655+00	-6.976+02	0.000	9.976+01
14	2	1.667+00	-1.011+01	-1.981+00	0.000	1.000+00	0.000	6.333+00	-5.055+00	-1.655+00	-6.976+02	0.000	9.976+01
15	2	1.667+00	1.907+00	-1.981+00	0.000	1.000+00	0.000	6.333+00	5.055+00	-1.655+00	-6.976+02	0.000	9.976+01
16	2	1.667+00	1.011+01	-1.981+00	0.000	1.000+00	0.000	6.333+00	1.517+01	-1.655+00	-6.976+02	0.000	9.976+01
17	2	1.667+00	2.022+01	-1.981+00	0.000	1.000+00	0.000	6.333+00	2.528+01	-1.655+00	-6.976+02	0.000	9.976+01
18	2	1.667+00	3.033+01	-1.981+00	9.123+03	9.999+01	-5.873+03	3.372+00	3.538+01	-1.686+00	-6.957+02	6.494+03	9.976+01
19	2	1.759+00	4.043+01	-2.841+00	2.083+01	9.693+01	-1.344+01	7.294+00	4.541+01	-3.023+00	6.447+02	1.505+01	9.865+01
20	2	3.875+00	5.039+01	-3.421+00	2.083+01	9.688+01	-1.379+01	9.061+00	5.537+01	-3.896+00	5.589+02	1.524+01	9.867+01
21	2	5.990+00	6.035+01	-4.839+00	2.083+01	9.683+01	-1.415+01	1.083+01	6.533+01	-5.747+00	4.732+02	1.542+01	9.869+01
22	2	8.106+00	7.030+01	-6.294+00	2.083+01	9.678+01	-1.450+01	1.260+01	7.528+01	-7.174+00	3.879+02	1.561+01	9.870+01
23	2	1.022+01	8.026+01	-7.785+00	2.083+01	9.673+01	-1.485+01	1.436+01	8.524+01	-8.455+00	3.019+02	1.579+01	9.870+01
24	2	1.234+01	9.022+01	-9.314+00	2.083+01	9.668+01	-1.520+01	1.613+01	9.520+01	-1.004+01	-2.166+02	1.598+01	9.869+01
25	2	1.445+01	1.002+02	-1.088+01	2.083+01	9.663+01	-1.555+01	1.790+01	1.052+02	-1.165+01	-1.310+02	1.610+01	9.868+01
26	2	1.657+01	1.101+02	-1.248+01	2.083+01	9.657+01	-1.593+01	1.967+01	1.151+02	-1.329+01	4.578+03	1.634+01	9.866+01
27	2	1.869+01	1.201+02	-1.412+01	2.083+01	9.652+01	-1.625+01	2.143+01	1.251+02	-1.497+01	3.918+03	1.652+01	9.863+01
28	2	2.080+01	1.300+02	-1.580+01	2.083+01	9.646+01	-1.659+01	2.320+01	1.350+02	-1.667+01	1.237+02	1.670+01	9.859+01
1	3	2.525+01	-1.400+02	-1.755+01	-1.393+01	9.757+01	1.692+01	2.588+01	-1.350+02	-1.670+01	1.236+02	-1.692+01	9.855+01
2	3	2.383+01	-1.300+02	-1.582+01	-1.391+01	9.761+01	1.669+01	2.481+01	-1.251+02	-1.498+01	3.916+03	-1.680+01	9.858+01
3	3	2.241+01	-1.201+02	-1.412+01	-1.393+01	9.765+01	1.645+01	2.374+01	-1.151+02	-1.327+01	4.575+03	-1.668+01	9.860+01

## 6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

7	3	1.674+01	-8.026+01	-7.559+00	-1.394-01	9.780-01	1.551-01	1.946+01	-7.528+01	-6.635+00	-3.872-02	-1.619-01	9.861-01
8	3	1.532+01	-7.030+01	-5.981+00	-1.394-01	9.784-01	1.527-01	1.839+01	-6.533+01	-5.022+00	-4.727-02	-1.676-01	9.859-01
9	3	1.390+01	-6.035+01	-4.427+00	-1.394-01	9.788-01	1.503-01	1.732+01	-5.537+01	-3.428+00	-5.583-02	-1.593-01	9.856-01
10	3	1.248+01	-5.039+01	-2.898+00	-1.394-01	9.791-01	1.479-01	1.625+01	-4.541+01	-1.853+00	-6.439-02	-1.580-01	9.853-01
11	3	1.106+01	-4.043+01	-1.394+00	-0.162-03	1.000+00	0.000	1.569+01	-3.538+01	-1.036+00	-6.957-02	-0.844-03	9.976-01
12	3	1.000+01	-3.033+01	-1.329+00	0.000	1.000+00	0.000	1.567+01	-2.528+01	-1.002+00	-6.976-02	0.000	9.976-01
13	3	1.100+01	-2.022+01	-1.329+00	0.000	1.000+00	0.000	1.567+01	-1.517+01	-1.002+00	-6.976-02	0.000	9.976-01
14	3	1.100+01	-1.011+01	-1.329+00	0.000	1.000+00	0.000	1.567+01	-0.505+00	-1.002+00	-6.976-02	0.000	9.976-01
15	3	1.100+01	0.967+00	-1.329+00	0.000	1.000+00	0.000	1.567+01	0.505+00	-1.002+00	-6.976-02	0.000	9.976-01
16	3	1.100+01	1.011+01	-1.329+00	0.000	1.000+00	0.000	1.567+01	1.517+01	-1.002+00	-6.976-02	0.000	9.976-01
17	3	1.100+01	2.022+01	-1.329+00	0.000	1.000+00	0.000	1.567+01	2.528+01	-1.002+00	-6.976-02	0.000	9.976-01
18	3	1.100+01	3.033+01	-1.329+00	0.162-03	1.000+00	-0.434-03	1.569+01	3.538+01	-1.036+00	-6.957-02	0.844-03	9.976-01
19	3	1.106+01	4.043+01	-1.394+00	1.394-01	9.791-01	-1.479-01	1.625+01	4.541+01	-1.853+00	-6.439-02	1.580-01	9.853-01
20	3	1.248+01	5.039+01	-2.898+00	1.394-01	9.788-01	-1.503-01	1.732+01	5.537+01	-3.428+00	-5.583-02	1.593-01	9.856-01
21	3	1.390+01	6.035+01	-4.427+00	1.394-01	9.784-01	-1.527-01	1.839+01	6.533+01	-5.022+00	-4.727-02	1.676-01	9.859-01
22	3	1.532+01	7.030+01	-5.981+00	1.394-01	9.780-01	-1.551-01	1.946+01	7.528+01	-6.635+00	-3.872-02	1.619-01	9.861-01
23	3	1.674+01	8.026+01	-7.559+00	1.394-01	9.777-01	-1.574-01	2.053+01	8.524+01	-8.267+00	-3.017-02	1.631-01	9.861-01
24	3	1.816+01	9.022+01	-9.163+00	1.394-01	9.773-01	-1.598-01	2.160+01	9.520+01	-9.917+00	-2.162-02	1.643-01	9.862-01
25	3	1.957+01	1.002+02	-1.079+00	1.394-01	9.769-01	-1.622-01	2.267+01	1.052+02	-1.159+01	-1.309-02	1.656-01	9.861-01
26	3	2.099+01	1.101+02	-1.244+00	1.394-01	9.765-01	-1.645-01	2.374+01	1.151+02	-1.327+01	-4.575-03	1.668-01	9.860-01
27	3	2.241+01	1.201+02	-1.412+00	1.394-01	9.761-01	-1.669-01	2.481+01	1.251+02	-1.498+01	3.916-03	1.680-01	9.858-01
28	3	2.383+01	1.300+02	-1.582+00	1.390-01	9.757-01	-1.692-01	2.588+01	1.350+02	-1.670+01	1.236-02	1.692-01	9.855-01

1	4	2.775+01	-1.400+02	-1.759+00	-0.000-02	9.829-01	1.720-01	2.914+01	-1.350+02	-1.674+01	1.236-02	-1.715-01	9.851-01
2	4	2.708+01	-1.300+02	-1.585+00	-0.000-02	9.831-01	1.708-01	2.891+01	-1.251+02	-1.500+01	3.914-03	-1.710-01	9.853-01
3	4	2.641+01	-1.201+02	-1.412+00	-0.000-02	9.833-01	1.697-01	2.869+01	-1.151+02	-1.325+01	-4.572-03	-1.704-01	9.854-01
4	4	2.573+01	-1.101+02	-1.240+00	-0.000-02	9.834-01	1.686-01	2.847+01	-1.052+02	-1.151+01	-1.308-02	-1.698-01	9.854-01
5	4	2.506+01	-1.002+02	-1.070+00	-0.000-02	9.836-01	1.675-01	2.824+01	-0.952+02	-0.977+00	-2.161-02	-1.692-01	9.853-01
6	4	2.439+01	-0.902+02	-0.901+00	-0.001-02	9.838-01	1.664-01	2.802+01	-0.852+02	-0.838+00	-3.014-02	-1.686-01	9.852-01
7	4	2.372+01	-0.802+02	-0.7317+00	-0.004-02	9.840-01	1.652-01	2.779+01	-0.752+02	-0.738+00	-3.868-02	-1.680-01	9.850-01
8	4	2.305+01	-0.703+02	-0.645+00	-0.004-02	9.842-01	1.641-01	2.757+01	-0.653+02	-0.582+00	-4.722-02	-1.674-01	9.848-01
9	4	2.237+01	-0.603+02	-0.585+00	-0.004-02	9.844-01	1.630-01	2.735+01	-0.553+02	-0.480+00	-5.576-02	-1.667-01	9.844-01
10	4	2.170+01	-0.503+02	-0.537+00	-0.004-02	9.846-01	1.618-01	2.712+01	-0.454+02	-0.381+00	-6.431-02	-1.661-01	9.840-01
11	4	2.103+01	-0.403+02	-0.504+00	-0.004-03	1.000+00	0.000	2.700+01	-0.353+02	-0.271-01	-6.957-02	-7.219-03	9.976-01
12	4	2.100+01	-0.303+02	-0.493-01	0.000	1.000+00	0.000	2.700+01	-0.252+02	-0.209-01	-6.976-02	0.000	9.976-01
13	4	2.100+01	-0.202+02	-0.493-01	0.000	1.000+00	0.000	2.700+01	-0.151+02	-0.098-01	-6.976-02	0.000	9.976-01
14	4	2.100+01	-0.101+02	-0.493-01	0.000	1.000+00	0.000	2.700+01	-0.050+02	-0.098-01	-6.976-02	0.000	9.976-01
15	4	2.100+01	0.000+02	-0.493-01	0.000	1.000+00	0.000	2.700+01	0.050+02	-0.098-01	-6.976-02	0.000	9.976-01
16	4	2.100+01	0.101+02	-0.493-01	0.000	1.000+00	0.000	2.700+01	0.151+02	-0.098-01	-6.976-02	0.000	9.976-01
17	4	2.100+01	0.202+02	-0.493-01	0.000	1.000+00	0.000	2.700+01	0.252+02	-0.098-01	-6.976-02	0.000	9.976-01
18	4	2.100+01	0.303+02	-0.493-01	0.000	1.000+00	0.000	2.700+01	0.353+02	-0.271-01	-6.957-02	7.219-03	9.976-01
19	4	2.103+01	0.403+02	-0.504+00	0.004-02	9.846-01	-1.618-01	2.712+01	0.454+02	-0.381+00	-6.431-02	1.661-01	9.840-01
20	4	2.170+01	0.503+02	-0.537+00	0.004-02	9.844-01	-1.630-01	2.735+01	0.553+02	-0.480+00	-5.576-02	1.667-01	9.844-01
21	4	2.237+01	0.603+02	-0.585+00	0.004-02	9.842-01	-1.641-01	2.757+01	0.653+02	-0.582+00	-4.722-02	1.674-01	9.848-01
22	4	2.305+01	0.703+02	-0.645+00	0.004-02	9.840-01	-1.652-01	2.779+01	0.752+02	-0.738+00	-3.868-02	1.680-01	9.850-01
23	4	2.372+01	0.802+02	-0.7317+00	0.004-02	9.838-01	-1.664-01	2.802+01	0.852+02	-0.838+00	-3.014-02	1.686-01	9.852-01
24	4	2.439+01	0.902+02	-0.901+00	0.004-02	9.836-01	-1.675-01	2.824+01	0.952+02	-0.977+00	-2.161-02	1.692-01	9.853-01

JUBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 0 0 1 1 4 ALPHA = .00 MACHNO = .0000 ALTITUDE = \*\*\*\*\* 8

J	K	XV	YV	ZV	IXV	IYV	IZV	XN	YN	ZN	IXN	IYN	IZN
25	4	2.506+01	1.002+02	-1.070+00	0.000-02	9.834-01	-1.686-01	2.847+01	1.052+02	-1.151+01	-1.308-02	1.698-01	9.854-01
26	4	2.573+01	1.101+02	-1.240+00	0.000-02	9.833-01	-1.697-01	2.869+01	1.151+02	-1.325+01	-4.572-03	1.704-01	9.854-01
27	4	2.641+01	1.201+02	-1.412+00	0.000-02	9.831-01	-1.708-01	2.891+01	1.251+02	-1.500+01	3.914-03	1.710-01	9.853-01
28	4	2.708+01	1.300+02	-1.585+00	0.000-02	9.829-01	-1.720-01	2.914+01	1.350+02	-1.674+01	1.236-02	1.715-01	9.851-01

(EOF PLOT FILE 1) FILE # 1 = WING GEOMETRY

SOLID LINE INDICATES THE OUTPUT HAS BEEN EDITED

JUBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 0 0 1 1 4 ALPHA = .00 MACHNO = .0000 ALTITUDE = \*\*\*\*\* 9

LIFTING SURFACE NO = 2  
\*\*\*\*\*  
SURFACE # 2 = HORIZONTAL TAIL

SPAN	ROOT CHORD	TIP CHORD	ROOT TAIL	TIP TAIL	AREA	ASPECT RATIO	MEAN CHORD	MCC (MCC)	YBAR (MCC)	XBAR (MCC)	ZBAR (MCC)
87.770	37.000	20.000	-2.0000	-2.0000	2000.00	3.2000	25.000	25.333	18.667	131.000	-19.337
FLAP	FLAP	FLAP	FLAP	FLAP	FLAP	FLAP	FLAP	FLAP	FLAP	FLAP	FLAP
SPAN1	SPAN2	SPAN3	DEFLEC	DEFLEC	DEFLEC	DEFLEC	DEFLEC	DEFLEC	DEFLEC	DEFLEC	DEFLEC
.000	40.000	40.000	30.000	30.000	30.000	30.000	30.000	30.000	30.000	30.000	30.000
FUS STA	WING STA	HL STA	AREA	CHORD	SPAN	CHORD	SPAN	CHORD	SPAN	CHORD	SPAN
X(CG)	Y(CG)	Z(CG)	S(CG)	C(CG)	B(CG)	C(CG)	B(CG)	C(CG)	B(CG)	C(CG)	B(CG)
.000	.000	.000	3200.000	32.681	280.000	.000	.000	.000	.000	.000	.000

ORIGINAL PAGE IS  
OF POOR QUALITY

MS	Y	Z	X(CG)	X(CG)	X(T)	TWIST	DIHED(C/4)	SWEPT(C/4)	C(WING)	C(FLAP)	C(TAB)
-40.770	-47.000	-23.000	130.000	130.000	151.000	-2.000	.000	-10.620	20.000	10.000	3.000
-36.770	-36.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	21.000	10.000	3.000
-32.770	-32.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	22.000	10.000	3.000
-28.770	-28.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	23.000	10.000	3.000
-24.770	-24.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	24.000	10.000	3.000
-20.770	-20.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	25.000	10.000	3.000
-16.770	-16.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	26.000	10.000	3.000
-12.770	-12.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	27.000	10.000	3.000
-8.770	-8.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	28.000	10.000	3.000
-4.770	-4.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	29.000	10.000	3.000
.770	.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	30.000	10.000	3.000
4.770	4.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	31.000	10.000	3.000
8.770	8.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	32.000	10.000	3.000
12.770	12.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	33.000	10.000	3.000
16.770	16.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	34.000	10.000	3.000
20.770	20.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	35.000	10.000	3.000
24.770	24.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	36.000	10.000	3.000
28.770	28.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	37.000	10.000	3.000
32.770	32.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	38.000	10.000	3.000
36.770	36.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	39.000	10.000	3.000
40.770	40.000	-20.000	120.000	120.000	130.000	-2.000	.000	-10.620	40.000	10.000	3.000

# 6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

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35 3 1.425+02 1.000+01 -1.974+01 0.000 1.000+00 0.000 1.475+02 1.500+01 -1.991+01 3.490-02 0.000 9.994-01
36 3 1.425+02 2.000+01 -1.974+01 0.000 1.000+00 0.000 1.475+02 2.500+01 -1.991+01 3.490-02 0.000 9.994-01
37 3 1.425+02 3.000+01 -1.974+01 0.000 1.000+00 0.000 1.475+02 3.500+01 -1.991+01 3.490-02 0.000 9.994-01

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FILE # 2 = HORIZONTAL TAIL GEOMETRY  
(EOF PLOT FILE 2)

\* DIVIDE CHECK AT 026442 OK TO IGNORE

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JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO=.0000 ALTITUDE=***** 12

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LIFTING SURFACE NO= 3  
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SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MGC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
.000	80.000	200.000	.0000	.0000	.06	.0000	.000	148.568	.000	-12.858	-11.428
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.600	1.000	.000	.000	.000	.000	89.999	56.310	2	4	0
FUS STA X(CG)	WING STA Y(CG)	HL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)						
.000	.000	.000	8270.000	32.681	280.000						

WS	Y	Z	X(LE)	X(C/4)	X(TIP)	TWIST	DIHED(C/4)	SWEEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-20.000	.000	-20.000	-50.000	.000	150.000	.000	-89.999	-56.310	200.000	50.000	25.000
-18.000	.000	-18.000	-50.000	.000	138.000	.000	-89.999	-56.310	188.000	47.000	23.500
-16.000	.000	-16.000	-50.000	.000	126.000	.000	-89.999	-56.310	176.000	44.000	22.000
-14.000	.000	-14.000	-50.000	.000	114.000	.000	-89.999	-56.310	164.000	41.000	20.500
-12.000	.000	-12.000	-50.000	.000	102.000	.000	-89.999	-56.310	152.000	38.000	19.000
-10.000	.000	-10.000	-50.000	.000	90.000	.000	-89.999	-56.310	140.000	35.000	17.500
-8.000	.000	-8.000	-50.000	.000	78.000	.000	-89.999	-56.310	128.000	32.000	16.000
-6.000	.000	-6.000	-50.000	.000	66.000	.000	-89.999	-56.310	116.000	29.000	14.500
-4.000	.000	-4.000	-50.000	.000	54.000	.000	-89.999	-56.310	104.000	26.000	13.000
-2.000	.000	-2.000	-50.000	.000	42.000	.000	-89.999	-56.310	92.000	23.000	11.500
.000	.000	.000	-50.000	.000	30.000	.000	-89.999	-56.310	80.000	20.000	10.000
2.000	.000	2.000	-50.000	.000	18.000	.000	-89.999	-56.310	68.000	17.000	8.500
4.000	.000	4.000	-50.000	.000	6.000	.000	-89.999	-56.310	56.000	14.000	7.000
6.000	.000	6.000	-50.000	.000	.000	.000	-89.999	-56.310	44.000	11.000	5.500
8.000	.000	8.000	-50.000	.000	.000	.000	-89.999	-56.310	32.000	8.000	4.000
10.000	.000	10.000	-50.000	.000	.000	.000	-89.999	-56.310	20.000	4.000	2.000
12.000	.000	12.000	-50.000	.000	.000	.000	-89.999	-56.310	8.000	0.000	0.000
14.000	.000	14.000	-50.000	.000	.000	.000	-89.999	-56.310	0.000	0.000	0.000
16.000	.000	16.000	-50.000	.000	.000	.000	-89.999	-56.310	0.000	0.000	0.000
18.000	.000	18.000	-50.000	.000	.000	.000	-89.999	-56.310	0.000	0.000	0.000
20.000	.000	20.000	-50.000	.000	.000	.000	-89.999	-56.310	0.000	0.000	0.000

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39 4 1.125+02 0.000 -2.000+01 -9.790-01 0.000 2.009-01 8.125+01 0.000 -1.000+01 0.000 -1.000+00 0.000
40 4 1.500+01 0.000 0.000 9.790-01 0.000 -2.009-01 8.125+01 0.000 -1.000+01 0.000 -1.000+00 0.000

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FILE # 3 = FUSELAGE GEOMETRY  
(EOF PLOT FILE 3)

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JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO=.0000 ALTITUDE=***** 14

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LIFTING SURFACE NO= 4  
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SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MGC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
30.000	25.000	10.000	.0000	.0000	525.00	1.7143	17.500	18.571	40.000	136.072	-22.857
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	30.000	30.000	.000	.000	.000	.000	89.999	20.556	3	4	1
FUS STA X(CG)	WING STA Y(CG)	HL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)						
.000	.000	.000	8270.000	32.681	280.000						

WS	Y	Z	X(LE)	X(C/4)	X(TIP)	TWIST	DIHED(C/4)	SWEEP(C/4)	C(WING)	C(FLAP)	C(TAB)
.000	40.000	-10.000	125.000	131.250	150.000	.000	-14.036	72.560	25.000	12.500	2.500
1.500	40.000	-11.500	125.750	131.812	150.000	.000	89.999	20.556	24.250	12.125	2.425
3.000	40.000	-13.000	126.500	132.375	150.000	.000	89.999	20.556	23.500	11.750	2.350
4.500	40.000	-14.500	127.250	132.937	150.000	.000	89.999	20.556	22.750	11.375	2.275
6.000	40.000	-16.000	128.000	133.500	150.000	.000	89.999	20.556	22.000	11.000	2.200
7.500	40.000	-17.500	128.750	134.062	150.000	.000	89.999	20.556	21.250	10.625	2.125
9.000	40.000	-19.000	129.500	134.625	150.000	.000	89.999	20.556	20.500	10.250	2.050
10.500	40.000	-20.500	130.250	135.187	150.000	.000	89.999	20.556	19.750	9.875	1.975
12.000	40.000	-22.000	131.000	135.750	150.000	.000	89.999	20.556	19.000	9.500	1.900
13.500	40.000	-23.500	131.750	136.312	150.000	.000	89.999	20.556	18.250	9.125	1.825
15.000	40.000	-25.000	132.500	136.875	150.000	.000	89.999	20.556	17.500	8.750	1.750
16.500	40.000	-26.500	133.250	137.437	150.000	.000	89.999	20.556	16.750	8.375	1.675
18.000	40.000	-28.000	134.000	138.000	150.000	.000	89.999	20.556	16.000	8.000	1.600
19.500	40.000	-29.500	134.750	138.562	150.000	.000	89.999	20.556	15.250	7.625	1.525
21.000	40.000	-31.000	135.500	139.125	150.000	.000	89.999	20.556	14.500	7.250	1.450
22.500	40.000	-32.500	136.250	139.687	150.000	.000	89.999	20.556	13.750	6.875	1.375
24.000	40.000	-34.000	137.000	140.250	150.000	.000	89.999	20.556	13.000	6.500	1.300
25.500	40.000	-35.500	137.750	140.812	150.000	.000	89.999	20.556	12.250	6.125	1.225
27.000	40.000	-37.000	138.500	141.375	150.000	.000	89.999	20.556	11.500	5.750	1.150
28.500	40.000	-38.500	139.250	141.937	150.000	.000	89.999	20.556	10.750	5.375	1.075
30.000	40.000	-40.000	140.000	142.500	150.000	.000	89.999	20.556	10.000	5.000	1.000

## 6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
 VALUE 28 8 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 1 4 ALFA=.00 MACHNO=.0000 ALTITUDE=\*\*\*\*\* 15

XA(1)/C XA(2)/C XA(3)/C XA(4)/C XA(5)/C XA(6)/C XA(7)/C XA(8)/C XA(9)/C XA(10)/C  
 .0000 1.0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000

X Y ZA(1)/C ZA(2)/C ZA(3)/C ZA(4)/C ZA(5)/C ZA(6)/C ZA(7)/C ZA(8)/C ZA(9)/C ZA(10)/C  
 150.0000 40.0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000  
 150.0000 40.0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000

J K Y Z WL LW DWL DC CS  
 42 1 4.000+01 -1.500+01 5.000+00 4.320+02 1.000+01 4.167+00 3.750+01  
 43 1 4.000+01 -2.500+01 1.500+01 4.420+02 1.000+01 3.333+00 2.917+01  
 44 1 4.000+01 -3.500+01 2.500+01 4.520+02 1.000+01 2.500+00 2.083+01  
 42 2 4.000+01 -1.500+01 5.000+00 4.320+02 1.000+01 4.167+00 3.750+01  
 43 2 4.000+01 -2.500+01 1.500+01 4.420+02 1.000+01 3.333+00 2.917+01  
 44 2 4.000+01 -3.500+01 2.500+01 4.520+02 1.000+01 2.500+00 2.083+01  
 42 3 4.000+01 -1.500+01 5.000+00 4.320+02 1.000+01 4.167+00 3.750+01  
 43 3 4.000+01 -2.500+01 1.500+01 4.420+02 1.000+01 3.333+00 2.917+01  
 44 3 4.000+01 -3.500+01 2.500+01 4.520+02 1.000+01 2.500+00 2.083+01  
 42 4 4.000+01 -1.500+01 5.000+00 4.320+02 1.000+01 1.250+01 1.125+02  
 43 4 4.000+01 -2.500+01 1.500+01 4.420+02 1.000+01 1.000+01 8.750+01  
 44 4 4.000+01 -3.500+01 2.500+01 4.520+02 1.000+01 7.500+00 6.250+01

INPUT SURFACE

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
 VALUE 28 8 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 1 4 ALFA=.00 MACHNO=.0000 ALTITUDE=\*\*\*\*\* 16

J K XV YV ZV LAV LYV LZV XN YN ZN LXN LYN LZN  
 44 4 1.444+02 4.000+01 -3.000+01 1.843-01 0.000 -9.829-01 1.484+02 4.000+01 -3.500+01 0.000 1.000+00 0.000

(EOF PLOT FILE 4) FILE # 4 = LEFT VERTICAL FIN GEOMETRY

J K Y Z WL LW DWL DC CS  
 42 1 -4.000+01 -1.500+01 5.000+00 4.320+02 1.000+01 4.167+00 3.750+01  
 43 1 -4.000+01 -2.500+01 1.500+01 4.420+02 1.000+01 3.333+00 2.917+01  
 44 1 -4.000+01 -3.500+01 2.500+01 4.520+02 1.000+01 2.500+00 2.083+01  
 46 1 -4.000+01 -1.500+01 5.000+00 4.320+02 1.000+01 4.167+00 3.750+01  
 47 1 -4.000+01 -2.500+01 1.500+01 4.420+02 1.000+01 3.333+00 2.917+01  
 48 1 -4.000+01 -3.500+01 2.500+01 4.520+02 1.000+01 2.500+00 2.083+01  
 42 2 -4.000+01 -1.500+01 5.000+00 4.320+02 1.000+01 4.167+00 3.750+01  
 43 2 -4.000+01 -2.500+01 1.500+01 4.420+02 1.000+01 3.333+00 2.917+01  
 44 2 -4.000+01 -3.500+01 2.500+01 4.520+02 1.000+01 2.500+00 2.083+01  
 46 2 -4.000+01 -1.500+01 5.000+00 4.320+02 1.000+01 4.167+00 3.750+01  
 47 2 -4.000+01 -2.500+01 1.500+01 4.420+02 1.000+01 3.333+00 2.917+01  
 48 2 -4.000+01 -3.500+01 2.500+01 4.520+02 1.000+01 2.500+00 2.083+01  
 42 3 -4.000+01 -1.500+01 5.000+00 4.320+02 1.000+01 4.167+00 3.750+01  
 43 3 -4.000+01 -2.500+01 1.500+01 4.420+02 1.000+01 3.333+00 2.917+01  
 44 3 -4.000+01 -3.500+01 2.500+01 4.520+02 1.000+01 2.500+00 2.083+01  
 46 3 -4.000+01 -1.500+01 5.000+00 4.320+02 1.000+01 4.167+00 3.750+01  
 47 3 -4.000+01 -2.500+01 1.500+01 4.420+02 1.000+01 3.333+00 2.917+01  
 48 3 -4.000+01 -3.500+01 2.500+01 4.520+02 1.000+01 2.500+00 2.083+01  
 42 4 -4.000+01 -1.500+01 5.000+00 4.320+02 1.000+01 1.250+01 1.125+02  
 43 4 -4.000+01 -2.500+01 1.500+01 4.420+02 1.000+01 1.000+01 8.750+01  
 44 4 -4.000+01 -3.500+01 2.500+01 4.520+02 1.000+01 7.500+00 6.250+01  
 46 4 -4.000+01 -1.500+01 5.000+00 4.320+02 1.000+01 1.250+01 1.125+02  
 47 4 -4.000+01 -2.500+01 1.500+01 4.420+02 1.000+01 1.000+01 8.750+01  
 48 4 -4.000+01 -3.500+01 2.500+01 4.520+02 1.000+01 7.500+00 6.250+01

INPUT SURFACE + IMAGE SURFACE  
(NUTAIL MINUS)

J K XV YV ZV LAV LYV LZV XN YN ZN LXN LYN LZN  
 42 1 1.200+02 -4.000+01 -1.000+01 4.320+02 0.000 -9.018-01 1.303+02 -4.000+01 -1.500+01 0.000 1.000+00 0.000  
 43 1 1.308+02 -4.000+01 -2.000+01 4.320+02 0.000 -9.018-01 1.347+02 -4.000+01 -2.500+01 0.000 1.000+00 0.000  
 44 1 1.356+02 -4.000+01 -3.000+01 4.320+02 0.000 -9.018-01 1.391+02 -4.000+01 -3.500+01 0.000 1.000+00 0.000  
 46 1 1.200+02 4.000+01 -1.000+01 4.320+02 0.000 -9.018-01 1.303+02 4.000+01 -1.500+01 0.000 1.000+00 0.000  
 47 1 1.308+02 4.000+01 -2.000+01 4.320+02 0.000 -9.018-01 1.347+02 4.000+01 -2.500+01 0.000 1.000+00 0.000  
 48 1 1.356+02 4.000+01 -3.000+01 4.320+02 0.000 -9.018-01 1.391+02 4.000+01 -3.500+01 0.000 1.000+00 0.000

J K XV YV ZV LAV LYV LZV XN YN ZN LXN LYN LZN  
 44 2 1.381+02 -4.000+01 -3.000+01 4.000+01 0.000 -9.298-01 1.411+02 -4.000+01 -3.500+01 0.000 1.000+00 0.000  
 46 2 1.302+02 4.000+01 -1.000+01 4.000+01 0.000 -9.298-01 1.341+02 4.000+01 -1.500+01 0.000 1.000+00 0.000  
 47 2 1.342+02 4.000+01 -2.000+01 4.000+01 0.000 -9.298-01 1.376+02 4.000+01 -2.500+01 0.000 1.000+00 0.000  
 48 2 1.381+02 4.000+01 -3.000+01 4.000+01 0.000 -9.298-01 1.411+02 4.000+01 -3.500+01 0.000 1.000+00 0.000  
 42 3 1.344+02 -4.000+01 -1.000+01 4.000+01 0.000 -9.545-01 1.378+02 -4.000+01 -1.500+01 0.000 1.000+00 0.000  
 43 3 1.375+02 -4.000+01 -2.000+01 4.000+01 0.000 -9.545-01 1.405+02 -4.000+01 -2.500+01 0.000 1.000+00 0.000  
 44 3 1.406+02 -4.000+01 -3.000+01 4.000+01 0.000 -9.545-01 1.432+02 -4.000+01 -3.500+01 0.000 1.000+00 0.000  
 46 3 1.344+02 4.000+01 -1.000+01 4.000+01 0.000 -9.545-01 1.378+02 4.000+01 -1.500+01 0.000 1.000+00 0.000  
 47 3 1.375+02 4.000+01 -2.000+01 4.000+01 0.000 -9.545-01 1.405+02 4.000+01 -2.500+01 0.000 1.000+00 0.000  
 48 3 1.406+02 4.000+01 -3.000+01 4.000+01 0.000 -9.545-01 1.432+02 4.000+01 -3.500+01 0.000 1.000+00 0.000

J K XV YV ZV LAV LYV LZV XN YN ZN LXN LYN LZN  
 42 4 1.470+02 -4.000+01 -1.000+01 1.843-01 0.000 -9.829-01 1.472+02 -4.000+01 -1.500+01 0.000 1.000+00 0.000  
 43 4 1.425+02 -4.000+01 -2.000+01 1.843-01 0.000 -9.829-01 1.478+02 -4.000+01 -2.500+01 0.000 1.000+00 0.000  
 44 4 1.444+02 -4.000+01 -3.000+01 1.843-01 0.000 -9.829-01 1.484+02 -4.000+01 -3.500+01 0.000 1.000+00 0.000  
 46 4 1.470+02 4.000+01 -1.000+01 1.843-01 0.000 -9.829-01 1.472+02 4.000+01 -1.500+01 0.000 1.000+00 0.000  
 47 4 1.425+02 4.000+01 -2.000+01 1.843-01 0.000 -9.829-01 1.478+02 4.000+01 -2.500+01 0.000 1.000+00 0.000  
 48 4 1.444+02 4.000+01 -3.000+01 1.843-01 0.000 -9.829-01 1.484+02 4.000+01 -3.500+01 0.000 1.000+00 0.000

(EOF PLOT FILE 5) FILE # 5 = RIGHT VERTICAL FIN GEOMETRY (IMAGE)



## 6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
 VALUE 28 8 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO=.0000 ALTITUDE=\*\*\*\*\* 18

LIFTING SURFACE NO= 5  
 \*\*\*\*\*

SURFACE # 5 = ENGINE NACELLES

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MGC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
20.100	30.000	60.000	.0000	.0000	1050.00	.3810	52.500	54.285	40.000	-16.429	-9.952
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.600	1.000	.000	.000	.000	.000	89.999	36.870	2	6	0
FUS STA X(CG)	WING STA Y(CG)	HL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)						
.000	.000	.000	8200.000	32.681	280.000						

WS	Y	Z	X(LE)	A(L/4)	X(TE)	TWIST	DIHED(C/4)	SWEEP(C/4)	C(WING)	C(FLAP)	C(TAB)
.000	40.000	10.000	-30.000	-22.500	.000	.000	89.999	-73.142	30.000	7.500	3.750
1.000	40.000	9.000	-30.000	-21.750	3.000	.000	89.999	36.870	33.000	8.250	4.125
2.000	40.000	8.000	-30.000	-21.000	6.000	.000	89.999	36.870	36.000	9.000	4.500
3.000	40.000	7.000	-30.000	-20.250	9.000	.000	89.999	36.870	39.000	9.750	4.875
4.000	40.000	6.000	-30.000	-19.500	12.000	.000	89.999	36.870	42.000	10.500	5.250
5.000	40.000	5.000	-30.000	-18.750	15.000	.000	89.999	36.870	45.000	11.250	5.625
6.000	40.000	4.000	-30.000	-18.000	18.000	.000	89.999	36.870	48.000	12.000	6.000
7.000	40.000	3.000	-30.000	-17.250	21.000	.000	89.999	36.870	51.000	12.750	6.375
8.000	40.000	2.000	-30.000	-16.500	24.000	.000	89.999	36.870	54.000	13.500	6.750
9.000	40.000	1.000	-30.000	-15.750	27.000	.000	89.999	36.870	57.000	14.250	7.125
10.000	40.000	.000	-30.000	-15.000	30.000	.000	89.999	36.870	60.000	15.000	7.500
11.000	40.000	-1.000	-30.000	-14.250	30.000	.000	89.999	.000	60.000	15.000	7.500
12.000	40.000	-2.000	-30.000	-13.500	30.000	.000	89.999	.000	60.000	15.000	7.500
13.000	40.000	-3.000	-30.000	-12.750	30.000	.000	89.999	.000	60.000	15.000	7.500
14.000	40.000	-4.000	-30.000	-12.000	30.000	.000	89.999	.000	60.000	15.000	7.500
15.000	40.000	-5.000	-30.000	-11.250	30.000	.000	89.999	.000	60.000	15.000	7.500
16.000	40.000	-6.000	-30.000	-10.500	30.000	.000	89.999	.000	60.000	15.000	7.500
17.000	40.000	-7.000	-30.000	-9.750	30.000	.000	89.999	.000	60.000	15.000	7.500
18.000	40.000	-8.000	-30.000	-9.000	30.000	.000	89.999	.000	60.000	15.000	7.500
19.000	40.000	-9.000	-30.000	-8.250	30.000	.000	89.999	.000	60.000	15.000	7.500
20.000	40.000	-10.000	-30.000	-7.500	30.000	.000	89.999	.000	60.000	15.000	7.500

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
 VALUE 28 8 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO=.0000 ALTITUDE=\*\*\*\*\* 20

J	K	XV	YV	ZV	LXV	LYV	LZV	XN	YN	ZN	LXN	LYN	LZN
50	5	-8.750+01	4.000+01	1.000+01	9.046-01	0.000	-4.258-01	5.625+00	4.000+01	5.000+00	0.000	1.000+00	0.000
51	5	1.250+01	4.000+01	0.000	0.000	0.000	-1.000+00	1.750+00	4.000+01	-5.000+00	0.000	1.000+00	0.000
50	6	-3.750+00	4.000+01	1.000+01	9.343-01	0.000	-3.560-01	1.312+01	4.000+01	5.000+00	0.000	1.000+00	0.000
51	6	2.250+01	4.000+01	0.000	0.000	0.000	-1.000+00	2.750+01	4.000+01	-5.000+00	0.000	1.000+00	0.000

FILE # 6 = LEFT ENGINE NACELLE GEOMETRY

(EOF PLOT FILE 6)

J	K	Y	Z	ML	LM	DWL	DC	OS
50	1	-4.000+01	5.000+00	5.000+00	5.123+02	1.000+01	5.000+00	7.500+01
51	1	-4.000+01	-5.000+00	1.750+01	5.223+02	1.000+01	1.000+01	1.000+02

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
 VALUE 28 8 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO=.0000 ALTITUDE=\*\*\*\*\* 21

J	K	XV	YV	ZV	LXV	LYV	LZV	XN	YN	ZN	LXN	LYN	LZN
53	1	-2.875+01	4.000+01	1.000+01	1.224-01	0.000	-9.923-01	-2.438+01	4.000+01	5.000+00	0.000	1.000+00	0.000
54	1	-2.750+01	4.000+01	0.000	0.000	0.000	-1.000+00	-2.250+01	4.000+01	-5.000+00	0.000	1.000+00	0.000
50	2	-2.375+01	4.000+01	1.000+01	9.300-01	0.000	-8.480-01	-1.688+01	4.000+01	5.000+00	0.000	1.000+00	0.000
51	2	-1.750+01	4.000+01	0.000	0.000	0.000	-1.000+00	-1.250+01	4.000+01	-5.000+00	0.000	1.000+00	0.000
53	2	-2.375+01	4.000+01	1.000+01	9.300-01	0.000	-8.480-01	-1.688+01	4.000+01	5.000+00	0.000	1.000+00	0.000
54	2	-1.750+01	4.000+01	0.000	0.000	0.000	-1.000+00	-1.250+01	4.000+01	-5.000+00	0.000	1.000+00	0.000
50	3	-1.875+01	4.000+01	1.000+01	7.474-01	0.000	-6.644-01	-9.375+00	4.000+01	5.000+00	0.000	1.000+00	0.000
51	3	-7.500+00	4.000+01	0.000	0.000	0.000	-1.000+00	-2.500+00	4.000+01	-5.000+00	0.000	1.000+00	0.000
53	3	-1.875+01	4.000+01	1.000+01	7.474-01	0.000	-6.644-01	-9.375+00	4.000+01	5.000+00	0.000	1.000+00	0.000
54	3	-7.500+00	4.000+01	0.000	0.000	0.000	-1.000+00	-2.500+00	4.000+01	-5.000+00	0.000	1.000+00	0.000
50	4	-1.375+01	4.000+01	1.000+01	6.317-01	0.000	-5.241-01	-1.875+00	4.000+01	5.000+00	0.000	1.000+00	0.000
51	4	2.500+00	4.000+01	0.000	0.000	0.000	-1.000+00	7.500+00	4.000+01	-5.000+00	0.000	1.000+00	0.000
53	4	-1.375+01	4.000+01	1.000+01	6.317-01	0.000	-5.241-01	-1.875+00	4.000+01	5.000+00	0.000	1.000+00	0.000
54	4	2.500+00	4.000+01	0.000	0.000	0.000	-1.000+00	7.500+00	4.000+01	-5.000+00	0.000	1.000+00	0.000
50	5	-8.750+00	4.000+01	1.000+01	9.046-01	0.000	-4.258-01	5.625+00	4.000+01	5.000+00	0.000	1.000+00	0.000
51	5	1.250+01	4.000+01	0.000	0.000	0.000	-1.000+00	1.750+00	4.000+01	-5.000+00	0.000	1.000+00	0.000
53	5	-8.750+00	4.000+01	1.000+01	9.046-01	0.000	-4.258-01	5.625+00	4.000+01	5.000+00	0.000	1.000+00	0.000
54	5	1.250+01	4.000+01	0.000	0.000	0.000	-1.000+00	1.750+00	4.000+01	-5.000+00	0.000	1.000+00	0.000
50	6	-3.750+00	4.000+01	1.000+01	9.343-01	0.000	-3.560-01	1.312+01	4.000+01	5.000+00	0.000	1.000+00	0.000
51	6	2.250+01	4.000+01	0.000	0.000	0.000	-1.000+00	2.750+01	4.000+01	-5.000+00	0.000	1.000+00	0.000
53	6	-3.750+00	4.000+01	1.000+01	9.343-01	0.000	-3.560-01	1.312+01	4.000+01	5.000+00	0.000	1.000+00	0.000
54	6	2.250+01	4.000+01	0.000	0.000	0.000	-1.000+00	2.750+01	4.000+01	-5.000+00	0.000	1.000+00	0.000

FILE # 7 = RIGHT ENGINE NACELLE GEOMETRY (IMAGE)

(EOF PLOT FILE 7)

(NO VORTEX-LATTICE SOLUTIONS THIS TIME BECAUSE NSOLV = 12\*0)

\*\*\*\* JOB TIME = 40 / ELAPSED TIME = 40 / NO.PLOT FILES = 7 / NSURF EXEC. VERSION 6-1E-72 \*\*\*\*

# 2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 14 4 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 0 4 ALPHA=.00 MACHNO=.000C ALTITUDE=\*\*\*\*\* 22

\$INPUT  
KOUT = +6,  
KT1 = +1,  
KT2 = +8,  
KT3 = +3,  
LINX = +56,  
NWING = +2,  
NVTAIL = +0,  
NFUS = +0,  
CDOCP = .7500000E+00,  
CUDOF1 = .1000000E-03,  
CUDOF2 = .2900000E-02,  
LFLAP = +0,  
GSCALE = .1000000E+01,  
NSS = +3,  
NCS = +12,  
X = +2,  
Y = +2,  
NFLG = +2,  
NSOLV = +0,  
\$END

ONLY SURFACES # 1 AND 2, WING + TAIL ARE CONSIDERED NOW

ORIGINAL PAGE IS  
OF POOR QUALITY

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 14 4 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 0 4 ALPHA=.00 MACHNO=.000C ALTITUDE=\*\*\*\*\* 23

LIFTING SURFACE NU=1  
\*\*\*\*\*  
SURFACE # 1 = WING

SPAN	ROOT CHORD	TIP CHORD	KOUT	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
280.000	40.000	10.000	4.0000	-1.0000	8199.59	9.5615	29.284	32.681	56.591	5.489	-5.655
FLAP	FLAP	FLAP	FLAP	FLAP	L.AIL	R.AIL	DHED.	SWEET	NO.SPAN	NO.CHORD	NO.CHORD
SPAN1	SPAN2	SPAN3	DEFLEC	DEFLEC	DEFLEC	DEFLEC	MGC/4	MGC/4	ELEMENTS	ELEMENTS	DISCONT.
.000	40.000	140.000	30.000	.000	-20.000	15.000	10.000	12.494	14	4	1
FUS STA	WING STA	WL STA	AREA	CHORD	SPAN						
X(CG)	Y(CG)	Z(CG)	S(CG)	C(CG)	B(CG)						
.000	.000	.000	8200.000	32.681	280.000						

MS	Y	Z	X(LE)	X(C/4)	X(TE)	Twist	DIHE(C/4)	SWEET(C/4)	C(WING)	C(FLAP)	C(TAB)
-141.543	-140.000	-17.633	20.000	42.500	30.000	-1.000	-10.000	-12.494	10.000	3.000	.800
-127.388	-126.061	-15.175	15.000	19.364	30.000	-1.303	-10.000	-12.494	14.182	4.255	1.135
-113.234	-112.122	-12.717	11.000	10.227	30.000	.394	-10.000	-12.494	18.364	5.509	1.469

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 14 4 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 0 4 ALPHA=.00 MACHNO=.000C ALTITUDE=\*\*\*\*\* 27

LIFTING SURFACE NU=2  
\*\*\*\*\*  
SURFACE # 2 = HORIZONTAL TAIL

SPAN	ROOT CHORD	TIP CHORD	KOUT	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
80.000	30.000	20.000	-2.0000	-1.0000	2000.00	3.2000	25.000	25.333	18.667	131.000	-19.337
FLAP	FLAP	FLAP	FLAP	FLAP	L.AIL	R.AIL	DHED.	SWEET	NO.SPAN	NO.CHORD	NO.CHORD
SPAN1	SPAN2	SPAN3	DEFLEC	DEFLEC	DEFLEC	DEFLEC	MGC/4	MGC/4	ELEMENTS	ELEMENTS	DISCONT.
.000	40.000	40.000	-10.000	.000	.000	.000	.000	10.620	4	3	1
FUS STA	WING STA	WL STA	AREA	CHORD	SPAN						
X(CG)	Y(CG)	Z(CG)	S(CG)	C(CG)	B(CG)						
.000	.000	.000	8200.000	32.681	280.000						

MS	Y	Z	X(LE)	X(C/4)	X(TE)	Twist	DIHE(C/4)	SWEET(C/4)	C(WING)	C(FLAP)	C(TAB)
-40.000	-40.000	-20.000	130.000	130.000	150.000	-2.000	.000	-10.620	20.000	10.000	3.000
-36.000	-36.000	-20.000	120.000	130.000	150.000	-2.000	.000	-10.620	21.000	10.000	3.000
-32.000	-32.000	-20.000	120.000	130.000	150.000	-2.000	.000	-10.620	22.000	10.000	3.000
-28.000	-28.000	-20.000	120.000	130.000	150.000	-2.000	.000	-10.620	23.000	10.000	3.000
-24.000	-24.000	-20.000	120.000	130.000	150.000	-2.000	.000	-10.620	24.000	10.000	3.000
-20.000	-20.000	-20.000	120.000	130.000	150.000	-2.000	.000	-10.620	25.000	10.000	3.000
-16.000	-16.000	-20.000	120.000	130.000	150.000	-2.000	.000	-10.620	26.000	10.000	3.000

## 6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
 VALUE 14 4 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 0 4 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 29  
 NOTATION = 1/(2,1) INDICATES A SOLUTION FOR SURFACE # 1 IS OUT.  
 CONSIDERING SURFACE # 1 ONLY

## LIFT DISTRIBUTION DETAIL-SURFACE NO.= 1/1 1, 11

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
1	1	17.771	-130.043	-15.795	61.2737	3.3527	.34119	-.06387	.95313	.00681	-.04141	-.17854	-.4900+01
1	2	20.801	-130.043	-15.815	61.2737	1.7490	.05820	-.15014	.95501	.00755	-.01219	.11125	-.2596+01
1	3	23.831	-130.043	-15.836	61.2737	1.3455	.02500	-.16349	.97011	.01244	-.02245	.14417	-.2020+01
1	4	27.056	-130.011	-15.673	78.7805	1.4206	-.08275	-.19426	.95939	-.00291	-.05451	.24787	-.2750+01
2	1	12.145	-110.130	-12.544	89.4594	3.6325	.36292	-.04957	.96069	.01147	.04791	-.20024	-.7763+01
2	2	16.569	-110.130	-12.500	89.4594	1.8395	.04458	-.14618	.95622	.00767	-.01218	.12551	-.3991+01
2	3	20.994	-110.130	-12.456	89.4594	1.3923	.01126	-.16091	.97176	.01373	-.02528	.15789	-.3055+01
2	4	25.685	-110.066	-12.046	115.0192	1.4516	-.09578	-.17580	.95316	-.01031	-.06225	.26009	-.4114+01
3	1	6.520	-90.217	-5.490	117.6450	3.6835	.35231	-.04444	.96960	.01832	.05187	-.18846	-.1037+02
3	2	12.338	-90.217	-5.332	117.6450	1.8443	.02797	-.14298	.95842	.00863	-.01114	.14300	-.5268+01
3	3	18.156	-90.217	-5.175	117.6450	1.3934	-.00604	-.15867	.97241	.01407	-.02837	.17523	-.4023+01
3	4	24.326	-90.133	-4.530	151.2579	1.4599	-.11189	-.17427	.95098	-.01234	-.07074	.27510	-.5644+01
4	1	.894	-70.304	-6.631	145.8307	3.6999	.34018	-.03982	.98049	.02646	.05886	-.17482	-.1292+02
4	2	8.106	-70.304	-6.312	145.8307	1.8325	.01275	-.13974	.96273	.01119	-.00709	.15943	-.6496+01
4	3	15.318	-70.304	-5.993	145.8307	1.3765	-.02220	-.15653	.97496	.01600	-.02896	.19178	-.4930+01
4	4	22.967	-70.200	-5.080	187.4966	1.4587	-.12940	-.17317	.95062	-.01264	-.07727	.29190	-.6745+01
5	1	-4.731	-50.391	-3.969	174.0164	3.7010	.31920	-.03878	1.00180	.03905	.08887	-.14914	-.1544+02
5	2	3.875	-50.391	-3.440	174.0164	1.8710	-.00222	-.13817	.97988	.02102	.05250	.17948	-.7777+01
5	3	12.481	-50.391	-2.910	174.0164	1.3647	-.04057	-.15699	.99271	.02914	.00085	.21522	-.5837+01
5	4	21.551	-50.237	-1.473	223.7353	1.5111	-.15875	-.13925	.95198	-.00958	-.05840	.32466	-.8291+01
6	1	-7.605	-30.327	-2.661	188.4164	2.9548	.19307	-.00159	1.03889	.05375	.05764	-.01928	-.1377+02
6	2	1.713	-30.327	-2.011	188.4164	1.8781	-.05007	-.00323	1.02343	.03848	.03440	.22382	-.8753+01
6	3	11.031	-30.327	-1.361	188.4164	1.8211	-.07307	-.00357	1.04030	.05547	.01229	.24676	-.8488+01
6	4	20.707	-30.231	.631	242.2497	2.5312	-.27833	-.02616	.96685	-.01725	-.03472	.45125	-.1531+02
7	1	-7.667	-10.110	-2.634	188.7236	3.3639	.24995	.00000	1.03270	.04789	.00121	-.07631	-.1570+02
7	2	1.667	-10.110	-1.981	188.7236	1.9792	-.03493	.00000	1.01830	.03349	-.00063	.20857	-.9236+01
7	3	11.000	-10.110	-1.329	188.7236	1.7022	-.06998	.00000	1.04286	.05805	-.00232	.24363	-.8317+01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
 VALUE 14 4 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 0 4 ALFA= 10.00 MACHNO= .2000 ALTITUDE=\*\*\*\*\* 30  
 ALTITUDE = \*\*\*\*\* (OUT-OF-RANGE) INDICATES OUT-OF-GROUND SOLUTION

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
7	4	20.598	-10.110	.871	242.6446	2.5103	-.28709	.00000	.95976	-.02505	-.00408	.46074	-.1506+02
8	1	-7.667	10.110	-2.634	188.7236	3.0956	.21128	.00000	1.03348	.04867	-.00887	-.03764	-.1445+02
8	2	1.667	10.110	-1.981	188.7236	1.9130	-.04119	.00000	1.02066	.03586	.01086	.21483	-.8927+01
8	3	11.000	10.110	-1.329	188.7236	1.7759	-.07342	.00000	1.04517	.06036	.03008	.24707	-.8287+01
8	4	20.598	10.110	.871	242.6447	2.5360	-.28774	.00000	.96247	-.02233	.05741	.46138	-.1522+02
9	1	-7.605	30.327	-2.661	188.4164	1.7018	.00832	.00273	1.04643	.06073	-.15159	.16573	-.7931+01
9	2	1.713	30.327	-2.011	188.4164	1.5863	-.08984	.00343	1.02816	.04292	-.04669	.26378	-.7393+01
9	3	11.031	30.327	-1.361	188.4164	1.9069	-.08257	.00356	1.02887	.04394	-.04469	.25636	-.8887+01
9	4	20.812	30.330	.151	242.2497	2.7306	-.27140	.07493	.97250	-.00857	.05019	.44222	-.1630+02
10	1	-4.731	50.391	-3.969	174.0164	4.1886	.46248	-.00276	.99352	.00629	-.17412	-.28819	-.1748+02
10	2	3.875	50.391	-3.440	174.0164	1.2275	.05866	.12210	.95762	-.01324	-.07832	.12412	-.5197+01
10	3	12.481	50.391	-2.910	174.0164	.0575	.01032	.14506	.96198	-.00576	-.02547	.16699	-.2460+00
10	4	21.623	50.327	-2.705	223.7354	-1.0120	.08627	.20403	.96674	.00579	-.00429	.08615	.5596+01
11	1	.894	70.304	-6.631	145.8307	2.7466	.29936	.04758	.95330	.00598	-.03044	-.13597	-.9593+01
11	2	8.106	70.304	-6.312	145.8307	.9028	.02562	.13365	.94006	-.00739	.02986	.14276	-.3200+01
11	3	15.318	70.304	-5.993	145.8307	.1729	.00992	.14861	.95370	-.00249	.05172	.15377	-.6194+00
11	4	22.906	70.166	-6.432	187.4966	-.8072	.14641	.14447	.96873	.00081	.03465	.01952	.3739+01
12	1	6.520	90.217	-5.490	117.6451	2.2243	.25439	.06588	.94589	.00274	-.01894	-.09057	-.6260+01
12	2	12.338	90.217	-5.332	117.6451	.7000	.03237	.11975	.94368	-.00392	.02380	.13648	-.2000+01
12	3	18.156	90.217	-5.175	117.6451	.0548	.02020	.15283	.95951	.00165	.03383	.14750	-.1583+00
12	4	24.277	90.106	-5.636	151.2579	-.9048	.16038	.14584	.96904	-.00002	.01263	.00876	.3380+01
13	1	12.145	110.130	-12.544	89.4594	1.8027	.22442	.08557	.94099	.00103	-.01156	-.06041	-.3852+01
13	2	16.569	110.130	-12.500	89.4594	.5268	.04149	.14521	.94626	-.00069	.02140	.12722	-.1143+01
13	3	20.994	110.130	-12.456	89.4594	-.0457	.03258	.15657	.96396	.00583	.02580	.13597	.1003+00
13	4	25.648	110.046	-12.888	115.0192	-.9786	.17458	.14715	.96912	-.00024	.00293	-.00418	.2779+01
14	1	17.771	130.043	-15.795	61.2737	1.4769	.20591	.09940	.93714	-.00036	-.00721	-.04189	-.2159+01
14	2	20.801	130.043	-15.815	61.2737	.3656	.05347	.14983	.94730	.00105	.01920	.11496	-.5428+00
14	3	23.831	130.043	-15.836	61.2737	-.1681	.04725	.15941	.96484	.00872	.02022	.12175	.2524+00
14	4	27.039	130.000	-16.102	78.7805	-1.0584	.18867	.13981	.96958	-.00095	-.00176	-.01755	.2057+01

## SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/1 1, 11

J	Y*	Y	Z	W	SCN	SCX	SEL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
1	-.4644	-130.043	-15.805	131.433	1.8747	-.2683	1.8928	.2789	-.1718	.0878	.0830	.1551	-.9844
2	-.3933	-110.130	-12.522	111.212	1.9819	-.2948	2.0030	.2930	-.1648	.1356	.0961	.1349	-.9862

# 2. EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

3	-.3222	-90.217	-9.411	50.992	2.0043	-.2704	2.0207	.3011	-.1616	-1800	.1117	.1208	-.9864
4	-.2511	-70.304	-6.472	70.771	2.0121	-.2422	2.0236	.3073	-.1573	.2234	.1284	.1067	-.9860
5	-.1800	-50.391	-3.704	50.551	2.0607	-.1946	2.0632	.3240	-.1654	.2718	.1599	.1465	-.9762
6	-.1083	-30.327	-2.336	30.331	2.3410	.1312	2.2827	.4273	-.3828	.3256	.2765	.0260	-.9606
7	-.0361	-10.110	-2.308	10.110	2.4373	.0652	2.3889	.4366	-.3557	.3413	.2866	.0000	-.9581
8	.0361	10.110	-2.308	10.110	2.3674	.1151	2.3115	.4311	-.3721	.3302	.2864	.0000	-.9581
9	.1083	30.327	-2.336	30.331	2.0505	-.2890	1.9692	.4063	-.4763	.2809	.2681	-.0740	-.9606
10	.1800	50.391	-3.704	50.551	.9796	-.4496	1.0428	.0920	.3296	.1374	.0870	.2057	.9747
11	.2511	70.304	-6.472	70.771	.6223	-.1647	.6415	.0775	.2238	.0708	.1478	.1459	.9782
12	.3222	90.217	-9.411	90.992	.4004	-.0955	.4109	.0529	.2246	.0366	.1615	.1469	.9759
13	.3933	110.130	-12.522	111.212	.2207	-.0486	.2258	.0299	.2254	.0153	.1753	.1478	.9734
14	.4644	130.043	-15.805	121.433	.0590	-.0140	.0605	.0078	.2332	.0028	.1891	.1401	.9719

## INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 1 \*\*\*\*\*

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	1.6858	-.0753	.0648	1.6733	.2186	-.1030	-.1375	-.0076	5.49	-5.66	8199.59	32.68	280.00
1	.1404*	.1345*	.0037*	.1149*	.1568*	.0243*	-.0094*	.0092*	5.49*	-5.66*	8199.59*	32.68*	280.00*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 14 4 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 0 4 ALFA= 10.00 MACHNO= .2000 ALTITUDE=\*\*\*\*\* 32

## \*\*\* AIRLOAD SUMS \*\*\*

AC	1.6858	-.0753	.0648	1.6733	.2186	-.1030	-.1375	-.0076	5.49	-5.66	8199.59	32.68	280.00
CG	1.6857	-.0753	.0648	1.6732	.2186	-.1030	-.1388	-.0063	.00	.00	8200.00	32.68	280.00
AC	.1404*	.1345*	.0037*	.1149*	.1568*	.0243*	-.0094*	.0092*	5.49*	-5.66*	8199.59*	32.68*	280.00*
CG	.1404*	.1345*	.0037*	.1149*	.1568*	.0243*	-.0095*	.0093*	.00*	.00*	8200.00*	32.68*	280.00*

\* DETERMINANT= .1721+35 \* SCALE= .4057-02 \*

THE LIFT COEFFICIENT FOR THE WING ALONE, 1/(1,1), IS  $C_L = 1.6733$  WITH L.E. SUCTION (BLUNT L.E.)  
= 1.7881 NO L.E. SUCTION (SHARP L.E.)

NOTATION = 1/(1,2) INDICATES SOLUTION FOR SURFACE # 1 IS OUTPUT

CONSIDERING SURFACES # 1 AND # 2 SIMULTANEOUSLY.

## LIFT DISTRIBUTION DETAIL-SURFACE NO.= 1/(1, 2) \*\*\*\*\*

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	V(X)	V(Y)	V(Z)	GAMA
1	1	17.771	-130.043	-15.795	61.2737	3.1425	.31837	-.07038	.95354	.00802	.03862	-.15499	-.4593+01
1	2	20.801	-130.043	-15.815	51.2737	1.6534	.05411	-.15123	.95632	.00875	-.01141	.11563	-.2454+01
1	3	23.931	-130.043	-15.836	61.2737	1.2875	.02272	-.16403	.97138	.01353	-.02097	.14675	-.1933+01
1	4	27.056	-130.011	-15.673	78.7805	1.3894	-.08469	-.19473	.96119	-.00124	-.05213	.25029	-.2690+01
2	1	12.145	-110.130	-12.544	89.4594	3.3616	.33326	-.05804	.96127	.01295	.04482	-.16955	-.7184+01
2	2	16.569	-110.130	-12.500	99.4594	1.7175	.03951	-.14761	.95838	.00952	-.01039	.13105	-.3727+01
2	3	20.994	-110.130	-12.456	89.4594	1.3184	.00832	-.16149	.97387	.01546	-.02226	.16141	-.2892+01
2	4	25.645	-110.066	-12.046	115.0192	1.4125	-.09848	-.17652	.95619	-.00756	-.05737	.26371	-.4003+01
3	1	6.520	-90.217	-5.490	117.6450	3.3530	.31651	-.05474	.97087	.02014	.05015	-.15115	-.9436+01
3	2	12.338	-90.217	-5.332	117.6450	1.6965	.02178	-.14486	.96210	.01146	-.00651	.15011	-.4884+01
3	3	18.156	-90.217	-5.175	117.6450	1.3052	-.00967	-.15976	.97597	.01674	-.02159	.18004	-.3769+01
3	4	24.326	-90.133	-4.530	151.2579	1.4156	-.11550	-.17528	.95533	-.00859	-.06081	.28052	-.5278+01
4	1	.894	-70.304	-4.631	145.8307	3.3054	.29793	-.05246	.98561	.02937	.06755	-.12933	-.1155+02
4	2	8.106	-70.304	-4.312	145.8307	1.6594	.00481	-.14261	.97073	.01588	.00967	.17011	-.5882+01
4	3	15.319	-70.304	-4.993	145.8307	1.2825	-.02760	-.15839	.98190	.02027	-.00915	.20042	-.4594+01
4	4	22.967	-70.200	-5.060	187.4966	1.4233	-.13463	-.17456	.95660	-.00816	-.05378	.30129	-.6581+01
5	1	-4.731	-50.391	-3.969	174.0164	3.0735	.22060	-.07095	1.03529	.05122	.16994	-.03546	-.1283+02
5	2	3.875	-50.391	-3.440	174.0164	1.7399	-.02271	-.14665	1.00926	.03140	.11899	.21380	-.7367+01
5	3	12.481	-50.391	-2.910	174.0164	1.3955	-.04723	-.16073	1.01103	.03501	.09099	.23575	-.5969+01
5	4	21.551	-50.237	-1.473	223.7353	1.5714	-.15479	-.19029	.95913	-.00789	.01769	.33482	-.8622+01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 14 4 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 0 4 ALFA= 10.00 MACHNO= .2000 ALTITUDE=\*\*\*\*\* 33

6	1	-7.605	-30.327	-2.661	198.4164	3.9243	.33613	-.00070	1.03018	.04427	.18413	-.16200	-.1829+02
6	2	1.713	-30.327	-2.011	198.4164	2.1643	-.02451	-.00309	1.01287	.02735	.15893	.19863	-.1009+02
6	3	11.031	-30.327	-1.361	188.4164	1.9240	-.06319	-.00352	1.03328	.04810	.12577	.23724	-.8967+01
6	4	20.707	-30.231	.631	242.2497	2.5434	-.27064	-.02594	.96082	-.02419	.04952	.44557	-.1538+02
7	1	-7.667	-10.110	-2.634	188.7236	4.7329	.42732	.03000	1.02377	.03896	.04678	-.25367	-.2209+02
7	2	1.667	-10.110	-1.981	188.7236	2.4835	-.00090	.00000	1.00259	.01779	.04444	.17455	-.1159+02
7	3	11.000	-10.110	-1.329	188.7236	2.0140	-.05192	.00000	1.03039	.04558	.03885	.22557	-.9399+01
7	4	20.598	-10.110	.871	242.6446	2.5658	-.27347	.00000	.94594	-.03887	.02672	.44712	-.1539+02
8	1	-7.667	10.110	-2.634	188.7236	4.5395	.40490	.00000	1.02298	.03818	-.06000	-.23126	-.2118+02
8	2	1.667	10.110	-1.981	188.7236	2.4184	-.00464	.00000	1.00421	.01940	-.03917	.17828	-.1129+02
8	3	11.000	10.110	-1.329	188.7236	1.9977	-.05550	.00000	1.03261	.04781	-.01502	.22915	-.9322+01
8	4	20.599	10.110	.871	242.6447	2.5856	-.27536	.00000	.94899	-.03581	.02470	.44401	-.1551+02
9	1	-7.605	30.327	-2.661	198.4164	2.4864	.12055	.00203	1.04000	.05349	-.28414	.05385	-.1159+02
9	2	1.713	30.327	-2.011	198.4164	1.9337	-.06992	.00331	1.01926	.03343	-.22668	.24423	-.8546+01
9	3	11.031	30.327	-1.361	188.4164	2.0084	-.07382	.00351	1.02224	.03495	-.16170	.24799	-.9360+01
9	4	20.812	30.339	.151	242.2497	2.7493	-.25802	.07435	.96841	-.01458	-.03993	.43522	-.1541+02
10	1	-4.731	50.391	-3.969	174.0164	3.6302	.37907	.02497	1.02369	.01616	-.25100	-.18991	-.1515+02
10	2	3.875	50.391	-3.440	174.0164	1.1086	.04230	.12928	.98401	-.00482	-.16684	.15344	-.4694+01
10	3	12.481	50.391	-2.910	174.0164	.0280	.00593	.14916	.97827	-.00128	-.11083	.18447	-.1199+00

## 6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

10	4	21.623	50.327	-2.705	223.7354	-1.0585	.09538	.20498	.97367	.00802	-.08489	.09426	.5853+01
11	1	.894	70.304	-6.631	145.8307	2.3284	.25476	.06073	.95726	.00868	-.03558	-.08850	-.8133+01
11	2	8.106	70.304	-6.312	145.8307	.7175	.01733	.13650	.94737	.00280	.01597	.15338	-.2543+01
11	3	15.318	70.304	-6.993	145.8307	.0672	.00482	.15045	.96079	.00225	.03417	.16334	-.2408+00
11	4	22.906	70.186	-6.432	187.4966	-.8666	.14342	.14527	.97242	.00329	.01610	.02551	.4014+01
12	1	6.520	90.217	-6.490	117.6451	1.8759	.21660	.07943	.94703	.00463	-.01646	-.05127	-.5279+01
12	2	12.339	90.217	-6.332	117.6451	.5447	.02590	.14172	.94753	.00280	.01943	.14385	-.1556+01
12	3	18.156	90.217	-6.175	117.6451	-.0391	.01649	.15407	.96388	.00515	.02703	.15239	.1128+00
12	4	24.277	90.106	-6.636	151.2579	-.9576	.15765	.14637	.97117	.00164	.00549	.01269	.3577+01
13	1	12.145	110.130	-12.564	89.4594	1.5216	.19363	.07437	.94152	.00261	-.00829	-.02857	-.3252+01
13	2	16.549	110.130	-12.500	89.4594	.4001	.03224	.14672	.94864	.00139	.01956	.13294	-.8681+00
13	3	20.994	110.130	-12.456	89.4594	-.1229	.02957	.15748	.96681	.00829	.02261	.13959	.2697+00
13	4	25.648	110.046	-12.888	115.0192	-1.0216	.17225	.14750	.97028	.00071	-.00023	-.00127	.2901+01
14	1	17.771	130.043	-15.795	61.2737	1.2612	.18248	.10609	.93761	.00093	-.00436	-.01770	-.1843+01
14	2	20.801	130.043	-15.815	61.2737	.2675	.04927	.15097	.94875	.00238	.01943	.11947	-.3971+00
14	3	23.831	130.043	-15.836	61.2737	-.2280	.04493	.15003	.96654	.00823	.01860	.12440	.3423+00

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 14 4 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 0 4 ALFA= 10.00 MACHNO= .209C ALTITUDE=\*\*\*\*\* 34

J	K	P(X)	P(Y)	P(Z)	AREA	CPA	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
14	4	27.039	130.000	-16.102	76.7805	-1.0510	.18681	.14706	.97032	-.00930	-.00338	-.01540	.2121+01

LIFT DISTRIBUTION DETAIL-SURFACE NO.= 2/( 1, 2)  
\*\*\*\*\*

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
16	1	129.962	-30.000	-19.264	145.0000	-2.0648	-.15909	-.04257	1.01734	.02604	.13977	.33758	.6303+01
16	2	135.312	-30.000	-19.487	145.0000	-1.1296	-.00198	-.00352	1.01865	.02474	.14480	.17611	.3514+01
16	3	142.476	-30.000	-20.064	200.0000	-.9998	.07207	.01089	.95773	.01278	.14485	.10001	.4999+01
17	1	124.687	-10.000	-19.116	175.0000	-2.3959	-.20035	-.05144	.99651	.03078	.02060	.37890	.1024+02
17	2	133.437	-10.000	-19.422	175.0000	-1.2065	-.00572	-.00384	1.00975	.02718	.02335	.17946	.5255+01
17	3	142.462	-9.996	-20.172	200.0000	-1.0484	.08261	-.00000	.99736	.01255	.02330	.09104	.5243+01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 14 4 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 0 4 ALFA= 10.00 MACHNO= .2000 ALTITUDE=\*\*\*\*\* 35

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	LXL	LYL	LZL
8	.0361	10.110	-2.308	10.110	2.8677	-.1868	2.8565	.4655	-.3274	.4081	.2787	.0000	-.9604
9	.1093	30.327	-2.336	30.331	2.3172	-.2074	2.2460	.4384	-.4495	.3203	.2567	-.0740	-.9636
10	.1800	50.351	-3.704	50.551	.8315	-.3056	.8719	.0913	.3204	.1149	.0954	.2051	.9741
11	.2511	70.304	-6.472	70.771	.4477	-.1057	.4593	.0584	.2239	.0507	.1443	.1462	.9787
12	.3222	90.217	-9.411	90.992	.2510	-.0535	.2565	.0343	.2255	.0228	.1585	.1472	.9763
13	.3933	110.130	-12.522	111.212	.0993	-.0188	.1010	.0140	.2262	.0068	.1729	.1480	.9738
14	.4644	130.043	-15.805	131.433	-.0344	.0069	-.0351	-.0048	.2339	-.0016	.1872	.1403	.9722

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 2/( 1, 2)  
\*\*\*\*\*

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	LXL	LYL	LZL
16	-.3750	-30.000	-19.378	311.563	-1.3465	-.0598	-1.3157	-.2442	.1100	-.3700	.0720	.0109	.9973
17	-.1250	-10.000	-19.269	291.563	-1.5277	-.1234	-1.4831	-.2867	.1088	-.5098	.0825	-.0000	.9966
18	-.1250	10.000	-19.269	291.563	-1.5890	-.1398	-1.5406	-.3002	.1024	-.5296	.0806	.0000	.9967
19	-.3750	30.000	-19.378	311.563	-1.2446	-.0397	-1.2188	-.2230	.1079	-.3428	.0676	-.0109	.9977

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 2  
\*\*\*\*\*

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	1.7593	-.1156	.0667	1.7526	.1917	-.0474	-.1396	-.0077	5.49	-5.66	8199.59	32.68	280.00
1	.1401*	.1362*	.0029*	.1143*	.1585*	.0292*	-.0091*	.0089*	5.49*	-5.66*	8199.59*	32.68*	280.00*
2	-1.4401	-.0948	-.0002	-1.4018	-.3434	.1023	.0065	-.0012	131.00	-19.34	2000.00	29.33	80.00
2	-.0977*	.0948*	.0000*	-.1127*	.0764*	-.0257*	.0012*	.0012*	131.00*	-19.34*	2000.00*	29.33*	80.00*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE  
VALUE 14 4 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 0 4 ALFA= 10.00 MACHNO= .2000 ALTITUDE=\*\*\*\*\* 36

\*\*\* AIRLOAD SUMS \*\*\*

AC	1.4080	-.1387	.0667	1.4107	.1079	1.3113	-.1391	-.0078	5.49	-5.66	8199.59	32.68	280.00
CG	1.4080	-.1387	.0667	1.4107	.1079	1.0508	-.1405	-.0065	.00	.00	8200.00	32.68	280.00
AC	.1163*	-.1593*	.0029*	.0868*	.1771*	.1255*	-.0090*	.0070*	5.49*	-5.66*	8199.59*	32.68*	280.00*
CG	.1163*	-.1593*	.0029*	.0868*	.1771*	.1336*	-.0091*	.0070*	.00*	.00*	8200.00*	32.68*	280.00*

\* DETERMINANT= .2376+13 \* SCALE= .3941-02 \*

END OF KQT NSURF

\*\*\*\* JOB TIME= 68 / ELAPSED TIME= 79 / NO.PLOT FILES= 7 / NSURF EXEC. VERSION 6-18-72 \*\*\*\*

# 5.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

XQT TRMPLT

31 AUG 72

12\*43\*37.905

KUNIT = 8  
ICCOMP = 0  
NTRAN = 0  
IPRINT = 0  
NTYPE = 0  
NDFSEL = 1  
ISCALY = 1,1,1,1,1,1,1,1,1,1  
NXL = 24  
NXR = 24  
NYL = 24  
NYH = 24  
NPOSN1 = 600, 950  
NPOSN2 = 600, 925  
NPOSN3 = 600, 900  
NPOSN4 = 600, 50  
ANNOT1 = 10 = EXAMPLE PRGB. 1 - MULTIPLE-SURFACE  
ANNOT2 = 10 = CAPABILITY DEMONSTRATION RUN  
ANNOT3 = 10 = AUGUST 5 JULY 72  
ANNOT4 = 10 =  
CHARSZ = 1.0,1.0,1.0,1.0  
TITLE = 10 = ISOMETRIC PROJECTION OF LIFTING SURFACES  
XLABEL = 10 = HORIZONTAL AXIS, SEMISPANS  
YLABEL = 10 = VERTICAL AXIS, SEMISPANS  
XHI = 1.5  
XLO = -1.0  
YHI = 1.5  
YLO = -1.0  
PLOT = 2,1, 3,1, ENULST  
ENDPLT  
NOADV = 0  
NOADV = 1  
PLOT = 5,1, 6,1, ENULST  
ENDPLT  
NOADV = 1  
PLOT = 2,2, 3,2, ENULST  
ENDPLT  
NOADV = 1  
PLOT = 2,3, 3,3, ENULST  
ENDPLT  
ENDFIL

START OF XQT TRMPLT (PLOT OPTION)

MICROFILM PLOT COMPLETED

NOADV = 1  
PLOT = 2,1, 3,1, ENULST  
ENDPLT  
NOADV = 1  
PLOT = 5,1, 6,1, ENULST  
ENDPLT  
NOADV = 1  
PLOT = 2,2, 3,2, ENULST  
ENDPLT  
NOADV = 1  
PLOT = 2,3, 3,3, ENULST  
ENDPLT  
ENDFIL

MICROFILM PLOT COMPLETED

NOADV = 1  
PLOT = 2,1, 3,1, ENULST  
ENDPLT  
NOADV = 1  
PLOT = 5,1, 6,1, ENULST  
ENDPLT  
NOADV = 1  
PLOT = 2,2, 3,2, ENULST  
ENDPLT  
NOADV = 1  
PLOT = 2,3, 3,3, ENULST  
ENDPLT  
ENDFIL

MICROFILM PLOT COMPLETED

NOADV = 1  
PLOT = 2,1, 3,1, ENULST  
ENDPLT  
NOADV = 1  
PLOT = 5,1, 6,1, ENULST  
ENDPLT  
NOADV = 1  
PLOT = 2,2, 3,2, ENULST  
ENDPLT  
NOADV = 1

NOADV = 1  
PLOT = 2,3, 3,3, ENULST  
ENDPLT  
ENDFIL

SOME OF THE OUTPUT OMITTED, SEE INPUT-DATA LISTING ON PAGES 6-1 AND 6-2.

MICROFILM PLOT COMPLETED

NOADV = 1  
PLOT = 2,1, 3,1, ENULST  
ENDPLT  
NOADV = 1  
PLOT = 5,1, 6,1, ENULST  
ENDPLT  
NOADV = 1  
PLOT = 2,2, 3,2, ENULST  
ENDPLT  
NOADV = 1  
PLOT = 2,3, 3,3, ENULST  
ENDPLT  
ENDFIL

MICROFILM PLOT COMPLETED  
ENDFIL

ORIGINAL PAGE IS  
OF POOR QUALITY



### 3. EXAMPLE PROBLEM # 2. SINGLE SURFACE ANALYSIS CAPABILITY (CONTINUED)

```
NJOB = +1,
NJOB1 = +9,
ALFA = .5600000E+01, .0000000E+00, .0000000E+00,
      .0000000E+00, .0000000E+00, .0000000E+00, .7000000E+00,
      .0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
      .0000000E+00, .0000000E+00, .0000000E+00,
      .0000000E+00, .0000000E+00, .0000000E+00,
      .0000000E+00,
MACHN = .2000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
      .0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
      .0000000E+00, .0000000E+00, .0000000E+00,
HEIGHT = 1.000000E+05, 1.000000E+05, 1.000000E+05,
      .1000000E+05, .1000000E+05, .1000000E+05, .1000000E+05,
      .1000000E+05, .1000000E+05, .1000000E+05,
FLAPOJ = .3000000E+02, .0000000E+00, .0000000E+00,
      .0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
      .0000000E+00, .0000000E+00, .0000000E+00,
      .0000000E+00,
AIIPOJ = .1000000E+02, -.1000000E+02, .0000000E+00,
      .0000000E+00, .0000000E+00, .0000000E+00, .0000000E+00,
      .0000000E+00, .0000000E+00, .0000000E+00,
      .0000000E+00,
WCL = .1000000E+01, .0000000E+00, .2500000E+00,
      .5000000E+00, .7500000E+00, .1000000E+01, .1250000E+01,
      .1500000E+01, .1750000E+01, .2000000E+01, .5000000E+00,
      .6000000E+00, .8000000E+00, .9000000E+00, .1000000E+01,
      .1100000E+01, .1200000E+01, .1300000E+01, .1400000E+01,
      .1500000E+01, .1600000E+01,
CLEANF = .3500000E-02,
IFLG = +0, +0, +0, +1,
        +1, +1, +1, +1,
$END
```

```

JOBFLAG 1 2 3 4 5 6 7 8 9 10  EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION  PAGE
VALUE 1 0 16 0 1 4 0 1 0 0  ALPHA=***** MACHNO=.0000 FLAPD=.00 AILEROND=.00 .00 ALTITUDE=***** 2

```

# WING GEOMETRY

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
60.000	15.000	5.000	.00000	.0000	600.00	6.0000	10.000	10.833	12.500	-0.000	.0000

FLAP SPAN1	FLAP SPAN2	FLAP CHORD	WLRN SPAN1	WLRN SPAN2	WLRN CHORD	CIHD 1/4MG	SWEPT 1/4MG	NO.SPAN VORTICES	NO.SPAN DISCONT	NO.CHORD VORTICES	NO.CHORD DISCONT
.700	.625	.2500	.642	.56700	.2500	.999	-.900	16	0	4	1

2Y/Y	Y	XLE	XLE/Y	AHE	XTE	Z	E	SWEEP C/4	DTHD	C	CF
-1.000	-30.000	-1.250	.0000	2.500	3.750	.000	.000	.000	.000	5.000	1.250
-.875	-26.250	-1.563	.0000	3.125	4.688	.000	.000	.000	.000	6.250	1.563
-.750	-22.500	-1.875	.0000	3.750	5.625	.000	.000	.000	.000	7.500	1.875
-.625	-18.750	-2.188	.0000	4.375	6.563	.000	.000	.000	.000	8.750	2.188
-.500	-15.000	-2.500	.0000	5.000	7.500	.000	.000	.000	.000	10.000	2.500
-.375	-11.250	-2.813	.0000	5.625	8.438	.000	.000	.000	.000	11.250	2.813
-.250	-7.500	-3.125	.0000	6.250	9.375	.000	.000	.000	.000	12.500	3.125
-.125	-3.750	-3.438	.0000	6.875	10.312	.000	.000	.000	.000	13.750	3.438
.000	.000	-3.750	.0000	7.500	11.250	.000	.000	.000	.000	15.000	3.750
.125	3.750	-3.438	.0000	8.125	12.188	.000	.000	.000	.000	16.250	4.063
.250	7.500	-3.125	.0000	8.750	13.125	.000	.000	.000	.000	17.500	4.375
.375	11.250	-2.813	.0000	9.375	14.063	.000	.000	.000	.000	18.750	4.688
.500	15.000	-2.500	.0000	10.000	15.000	.000	.000	.000	.000	20.000	5.000
.625	18.750	-2.188	.0000	10.625	15.938	.000	.000	.000	.000	21.250	5.313
.750	22.500	-1.875	.0000	11.250	16.875	.000	.000	.000	.000	22.500	5.625
.875	26.250	-1.563	.0000	11.875	17.813	.000	.000	.000	.000	23.750	5.938
1.000	30.000	-1.250	.0000	12.500	18.750	.000	.000	.000	.000	25.000	6.250

[illegible]

Y	2Y/B	ZA(11)/C	ZA(12)/C	ZA(13)/C	ZA(14)/C	ZA(15)/C	ZA(16)/C	ZA(17)/C	ZA(18)/C	ZA(19)/C	ZA(101)/C
00000	00000	00000	00000								
3000000	100000	00000	00000								

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JOBFLAG 1 2 3 4 5 6 7 8 9 10  EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION  PAGE
VALUE 1 0 16 7 1 4 0 1 0 4  ALPHA=*****  RACHNO= .0001  FLAPD= .00  ATLERUND= .00  .00  ALTITUDE=*****  3

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J	K	Y	DY	DC	US
1	1	-2.813+01	3.750+00	1.476+00	3.623+00
2	1	-2.437+01	3.750+00	1.719+00	0.474+00
3	1	-2.262+01	3.750+00	2.031+00	7.601+00
4	1	-1.687+01	3.750+00	2.344+00	0.707+00
5	1	-1.312+01	3.750+00	2.556+00	7.707+00
6	1	-9.375+00	3.750+00	2.969+00	1.143+01
7	1	-5.625+00	3.750+00	3.281+00	1.623+01
8	1	-1.875+00	3.750+00	3.694+00	1.349+01
9	1	1.875+00	3.750+00	3.594+00	1.350+01
10	1	5.625+00	3.750+00	3.281+00	1.623+01
11	1	9.375+00	3.750+00	2.969+00	1.143+01
12	1	1.312+01	3.750+00	2.556+00	7.707+00
13	1	1.687+01	3.750+00	2.344+00	0.707+00
14	1	2.762+01	3.750+00	2.031+00	7.601+00
15	1	2.437+01	3.750+00	1.719+00	0.474+00
16	1	2.813+01	3.750+00	1.476+00	3.623+00

ORIGINAL PAGE IS  
OF POOR QUALITY



## 6.3 EXAMPLE PROBLEM # 2, SINGLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

1	2	-2.813+01	3.750+00	1.406+00	5.273+00
2	2	-2.437+01	3.750+00	1.719+00	6.445+00
3	2	-2.062+01	3.750+00	2.031+00	7.617+00
4	2	-1.687+01	3.750+00	2.344+00	8.789+00
5	2	-1.312+01	3.750+00	2.656+00	9.961+00
6	2	-9.375+00	3.750+00	2.969+00	1.113+01
7	2	-5.625+00	3.750+00	3.281+00	1.230+01
8	2	-1.875+00	3.750+00	3.594+00	1.346+01
9	2	1.875+00	3.750+00	3.594+00	1.346+01
10	2	5.625+00	3.750+00	3.281+00	1.230+01
11	2	9.375+00	3.750+00	2.969+00	1.113+01
12	2	1.312+01	3.750+00	2.656+00	9.961+00
13	2	1.687+01	3.750+00	2.344+00	8.789+00
14	2	2.062+01	3.750+00	2.031+00	7.617+00
15	2	2.437+01	3.750+00	1.719+00	6.445+00
16	2	2.813+01	3.750+00	1.406+00	5.273+00

1	3	-2.813+01	3.750+00	1.406+00	5.273+00
2	3	-2.437+01	3.750+00	1.719+00	6.445+00
3	3	-2.062+01	3.750+00	2.031+00	7.617+00
4	3	-1.687+01	3.750+00	2.344+00	8.789+00
5	3	-1.312+01	3.750+00	2.656+00	9.961+00
6	3	-9.375+00	3.750+00	2.969+00	1.113+01
7	3	-5.625+00	3.750+00	3.281+00	1.230+01
8	3	-1.875+00	3.750+00	3.594+00	1.346+01
9	3	1.875+00	3.750+00	3.594+00	1.346+01
10	3	5.625+00	3.750+00	3.281+00	1.230+01
11	3	9.375+00	3.750+00	2.969+00	1.113+01
12	3	1.312+01	3.750+00	2.656+00	9.961+00
13	3	1.687+01	3.750+00	2.344+00	8.789+00
14	3	2.062+01	3.750+00	2.031+00	7.617+00

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
 VALUE 1 0 10 0 1 4 0 1 0 4 ALFA=\*\*\*\*\* PACHNO= .0000 FLAPD= .30 AILEROND= .00 .00 ALTITUDE=\*\*\*\*\* 4

J	K	Y	BY	OC	US
15	3	2.437+01	3.750+00	1.719+00	6.445+00
16	3	2.813+01	3.750+00	1.406+00	5.273+00

1	4	-2.813+01	3.750+00	1.406+00	5.273+00
2	4	-2.437+01	3.750+00	1.719+00	6.445+00
3	4	-2.062+01	3.750+00	2.031+00	7.617+00
4	4	-1.687+01	3.750+00	2.344+00	8.789+00
5	4	-1.312+01	3.750+00	2.656+00	9.961+00
6	4	-9.375+00	3.750+00	2.969+00	1.113+01
7	4	-5.625+00	3.750+00	3.281+00	1.230+01
8	4	-1.875+00	3.750+00	3.594+00	1.346+01
9	4	1.875+00	3.750+00	3.594+00	1.346+01
10	4	5.625+00	3.750+00	3.281+00	1.230+01
11	4	9.375+00	3.750+00	2.969+00	1.113+01
12	4	1.312+01	3.750+00	2.656+00	9.961+00
13	4	1.687+01	3.750+00	2.344+00	8.789+00
14	4	2.062+01	3.750+00	2.031+00	7.617+00
15	4	2.437+01	3.750+00	1.719+00	6.445+00
16	4	2.813+01	3.750+00	1.406+00	5.273+00

J	K	XV	YV	ZV	IXV	IYV	IZV	XN	YN	ZN	IXN	IYN	IZN
1	1	-9.375+01	-3.000+01	0.000	-6.238+02	9.981+01	0.000	-3.516+01	-2.813+01	0.000	0.000	0.000	1.000+00
2	1	-1.172+00	-2.625+01	0.000	-6.238+02	9.981+01	0.000	-4.297+01	-2.437+01	0.000	0.000	0.000	1.000+00
3	1	-1.406+00	-2.250+01	0.000	-6.238+02	9.981+01	0.000	-5.078+01	-2.062+01	0.000	0.000	0.000	1.000+00
4	1	-1.641+00	-1.875+01	0.000	-6.238+02	9.981+01	0.000	-5.859+01	-1.687+01	0.000	0.000	0.000	1.000+00
5	1	-1.875+00	-1.500+01	0.000	-6.238+02	9.981+01	0.000	-6.641+01	-1.312+01	0.000	0.000	0.000	1.000+00
6	1	-2.109+00	-1.125+01	0.000	-6.238+02	9.981+01	0.000	-7.422+01	-9.375+00	0.000	0.000	0.000	1.000+00
7	1	-2.344+00	-7.500+00	0.000	-6.238+02	9.981+01	0.000	-8.203+01	-5.625+00	0.000	0.000	0.000	1.000+00
8	1	-2.578+00	-3.150+00	0.000	-6.238+02	9.981+01	0.000	-8.984+01	-1.875+00	0.000	0.000	0.000	1.000+00
9	1	-2.813+00	0.000	0.000	-6.238+02	9.981+01	0.000	-9.765+01	1.875+00	0.000	0.000	0.000	1.000+00
10	1	-2.578+00	3.150+00	0.000	-6.238+02	9.981+01	0.000	-8.203+01	5.625+00	0.000	0.000	0.000	1.000+00
11	1	-2.344+00	7.500+00	0.000	-6.238+02	9.981+01	0.000	-7.422+01	9.375+00	0.000	0.000	0.000	1.000+00
12	1	-2.109+00	1.125+01	0.000	-6.238+02	9.981+01	0.000	-6.641+01	1.312+01	0.000	0.000	0.000	1.000+00
13	1	-1.875+00	1.500+01	0.000	-6.238+02	9.981+01	0.000	-5.859+01	1.687+01	0.000	0.000	0.000	1.000+00
14	1	-1.641+00	1.875+01	0.000	-6.238+02	9.981+01	0.000	-5.078+01	2.062+01	0.000	0.000	0.000	1.000+00
15	1	-1.406+00	2.250+01	0.000	-6.238+02	9.981+01	0.000	-4.297+01	2.437+01	0.000	0.000	0.000	1.000+00
16	1	-1.172+00	2.625+01	0.000	-6.238+02	9.981+01	0.000	-3.516+01	2.813+01	0.000	0.000	0.000	1.000+00

1	2	3.125+01	-3.000+01	0.000	2.003+02	9.998+01	0.000	1.055+00	-2.813+01	0.000	0.000	0.000	1.000+00
2	2	3.906+01	-2.625+01	0.000	2.003+02	9.998+01	0.000	1.289+00	-2.437+01	0.000	0.000	0.000	1.000+00
3	2	4.688+01	-2.250+01	0.000	2.003+02	9.998+01	0.000	1.523+00	-2.062+01	0.000	0.000	0.000	1.000+00
4	2	5.469+01	-1.875+01	0.000	2.003+02	9.998+01	0.000	1.758+00	-1.687+01	0.000	0.000	0.000	1.000+00
5	2	6.250+01	-1.500+01	0.000	2.003+02	9.998+01	0.000	1.992+00	-1.312+01	0.000	0.000	0.000	1.000+00
6	2	7.031+01	-1.125+01	0.000	2.003+02	9.998+01	0.000	2.227+00	-9.375+00	0.000	0.000	0.000	1.000+00
7	2	7.813+01	-7.500+00	0.000	2.003+02	9.998+01	0.000	2.461+00	-5.625+00	0.000	0.000	0.000	1.000+00
8	2	8.594+01	-3.150+00	0.000	2.003+02	9.998+01	0.000	2.695+00	-1.875+00	0.000	0.000	0.000	1.000+00
9	2	9.375+01	0.000	0.000	2.003+02	9.998+01	0.000	2.929+00	1.875+00	0.000	0.000	0.000	1.000+00

11	2	1.813+01	1.500+00	0.000	-2.003+02	9.998+01	0.000	2.227+00	9.375+00	0.000	0.000	0.000	1.000+00
12	2	7.031+01	1.125+01	0.000	-2.003+02	9.998+01	0.000	1.992+00	1.312+01	0.000	0.000	0.000	1.000+00
13	2	6.250+01	1.500+01	0.000	-2.003+02	9.998+01	0.000	1.758+00	1.687+01	0.000	0.000	0.000	1.000+00
14	2	5.469+01	1.875+01	0.000	-2.003+02	9.998+01	0.000	1.523+00	2.062+01	0.000	0.000	0.000	1.000+00
15	2	4.688+01	2.250+01	0.000	-2.003+02	9.998+01	0.000	1.289+00	2.437+01	0.000	0.000	0.000	1.000+00
16	2	3.906+01	2.625+01	0.000	-2.003+02	9.998+01	0.000	1.055+00	2.813+01	0.000	0.000	0.000	1.000+00

1	3	1.563+00	-3.000+01	0.000	1.003+01	9.946+01	0.000	4.648+00	-2.813+01	0.000	0.000	0.000	1.000+00
2	3	1.953+00	-2.625+01	0.000	1.003+01	9.946+01	0.000	3.008+00	-2.437+01	0.000	0.000	0.000	1.000+00
3	3	2.344+00	-2.250+01	0.000	1.003+01	9.946+01	0.000	3.555+00	-2.062+01	0.000	0.000	0.000	1.000+00
4	3	2.734+00	-1.875+01	0.000	1.003+01	9.946+01	0.000	4.102+00	-1.687+01	0.000	0.000	0.000	1.000+00
5	3	3.125+00	-1.500+01	0.000	1.003+01	9.946+01	0.000	4.648+00	-1.312+01	0.000	0.000	0.000	1.000+00
6	3	3.516+00	-1.125+01	0.000	1.003+01	9.946+01	0.000	5.195+00	-9.375+00	0.000	0.000	0.000	1.000+00
7	3	3.906+00	-7.500+00	0.000	1.003+01	9.946+01	0.000	5.742+00	-5.625+00	0.000	0.000	0.000	1.000+00
8	3	4.297+00	-3.150+00	0.000	1.003+01	9.946+01	0.000	6.289+00	-1.875+00	0.000	0.000	0.000	1.000+00
9	3	4.688+00	0.000	0.000	1.003+01	9.946+01	0.000	6.836+00	1.875+00	0.000	0.000	0.000	1.000+00
10	3	4.297+00	3.150+00	0.000	1.003+01	9.946+01	0.000	5.742+00	5.625+00	0.000	0.000	0.000	1.000+00
11	3	3.906+00	7.500+00	0.000	1.003+01	9.946+01	0.000	5.195+00	9.375+00	0.000	0.000	0.000	1.000+00
12	3	3.516+00	1.125+01	0.000	1.003+01	9.946+01	0.000	4.648+00	1.312+01	0.000	0.000	0.000	1.000+00
13	3	3.125+00	1.500+01	0.000	1.003+01	9.946+01	0.000	4.102+00	1.687+01	0.000	0.000	0.000	1.000+00
14	3	2.734+00	1.875+01	0.000	1.003+01	9.946+01	0.000	3.555+00	2.062+01	0.000	0.000	0.000	1.000+00
15	3	2.344+00	2.250+01	0.000	1.003+01	9.946+01	0.000	3.008+00	2.437+01	0.000	0.000	0.000	1.000+00
16	3	1.953+00	2.625+01	0.000	1.003+01	9.946+01	0.000	2.461+00	2.813+01	0.000	0.000	0.000	1.000+00

## 6.3 EXAMPLE PROBLEM # 2, SINGLE SURFACE ANALYSIS CAPABILITY (CONTINUED)

1	4	2.813+00	-3.000+01	0.000	1.000+01	9.829+01	0.000	3.867+00	-2.813+01	0.000	0.000	0.000	1.000+00
2	4	3.516+00	-2.625+01	0.000	1.000+01	9.829+01	0.000	4.727+00	-2.437+01	0.000	0.000	0.000	1.000+00
3	4	4.219+00	-2.250+01	0.000	1.000+01	9.829+01	0.000	5.586+00	-2.062+01	0.000	0.000	0.000	1.000+00
4	4	4.922+00	-1.875+01	0.000	1.000+01	9.829+01	0.000	6.445+00	-1.687+01	0.000	0.000	0.000	1.000+00
5	4	5.625+00	-1.500+01	0.000	1.000+01	9.829+01	0.000	7.305+00	-1.312+01	0.000	0.000	0.000	1.000+00
6	4	6.328+00	-1.125+01	0.000	1.000+01	9.829+01	0.000	8.164+00	-9.375+00	0.000	0.000	0.000	1.000+00
7	4	7.031+00	-7.500+00	0.000	1.000+01	9.829+01	0.000	9.023+00	-5.625+00	0.000	0.000	0.000	1.000+00
8	4	7.734+00	-3.150+00	0.000	1.000+01	9.829+01	0.000	9.883+00	-1.875+00	0.000	0.000	0.000	1.000+00
9	4	8.438+00	0.000	0.000	1.000+01	9.829+01	0.000	10.742+00	1.875+00	0.000	0.000	0.000	1.000+00
10	4	7.734+00	3.150+00	0.000	1.000+01	9.829+01	0.000	9.883+00	5.625+00	0.000	0.000	0.000	1.000+00
11	4	7.031+00	7.500+00	0.000	1.000+01	9.829+01	0.000	9.023+00	9.375+00	0.000	0.000	0.000	1.000+00
12	4	6.328+00	1.125+01	0.000	1.000+01	9.829+01	0.000	8.164+00	1.312+01	0.000	0.000	0.000	1.000+00
13	4	5.625+00	1.500+01	0.000	1.000+01	9.829+01	0.000	7.305+00	1.687+01	0.000	0.000	0.000	1.000+00
14	4	4.922+00	1.875+01	0.000	1.000+01	9.829+01	0.000	6.445+00	2.062+01	0.000	0.000	0.000	1.000+00
15	4	4.219+00	2.250+01	0.000	1.000+01	9.829+01	0.000	5.586+00	2.437+01	0.000	0.000	0.000	1.000+00
16	4	3.516+00	2.625+01	0.000	1.000+01	9.829+01	0.000	4.727+00	2.813+01	0.000	0.000	0.000	1.000+00

(EOF PLOT FILE 1) FILE # 1 = PLANFORM AND ISOMETRIC PROJECTION OF WING GEOMETRY

JOHFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
 VALUE 1 0 16 0 1 4 0 1 0 4 ALPHA= 3.00 MACHNO= .2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=\*\*\*\*\* 6

LIFT DISTRIBUTION DETAIL  
\*\*\*\*\*

J	K	P(X)	P(Y)	P(Z)	AREA	CPA	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
1	1	-1.055	-28.125	0.000	0.2134	1.3278	1.0852	-0.1178	0.99082	-0.00340	-0.00089	-0.00174	-0.9404+00
1	2	0.352	-28.125	0.000	0.2134	0.3212	0.34974	-0.00083	0.99334	-0.00271	-0.00383	0.04741	-0.2273+00
1	3	1.758	-28.125	0.000	0.2134	-0.0910	0.30629	-0.00315	0.99150	-0.00017	-0.00811	0.05670	0.6482+00
1	4	3.155	-28.125	-0.070	0.2134	-0.6745	0.17748	0.28794	0.97888	-0.00176	-0.00830	-0.02180	0.4762+00
2	1	-1.289	-24.375	0.000	0.4433	1.9113	0.27112	-0.1094	0.98863	-0.00634	-0.00645	-0.18449	-0.1658+01
2	2	0.437	-24.375	0.000	0.4433	0.4738	0.05538	-0.00115	0.99292	-0.00508	-0.00127	0.03176	-0.4108+00
2	3	2.148	-24.375	0.000	0.4433	-0.0975	0.04019	-0.00419	0.99102	-0.00091	-0.00154	0.04675	0.8413+01
2	4	3.853	-24.375	-0.111	0.4433	-0.8292	0.12703	0.02447	0.97830	-0.00214	-0.00716	-0.00174	0.7159+00
3	1	-1.523	-20.625	0.000	1.0012	2.7622	0.41890	-0.2618	0.98731	-0.01063	0.05867	-0.33256	-0.2836+01
3	2	0.508	-20.625	0.000	1.0012	0.6154	0.07346	-0.00153	0.98927	-0.00588	0.03973	0.01368	-0.6317+00
3	3	2.539	-20.625	0.000	1.0012	-0.0922	0.02438	-0.00254	0.98661	-0.00223	0.01929	0.06264	0.9435+01
3	4	4.565	-20.625	-0.074	1.0012	-0.5961	0.05499	-0.00506	0.97736	-0.00059	0.00324	0.03137	0.6084+00
4	1	-1.758	-16.875	0.000	0.1091	1.0438	0.03108	0.00194	1.000915	0.00983	0.00152	0.05601	-0.1210+01
4	2	0.580	-16.875	0.000	0.1091	1.0541	-0.00785	0.00016	1.00239	0.00762	0.05801	-0.09501	-0.1232+01
4	3	2.931	-16.875	0.000	0.1091	1.2399	-0.00719	0.00075	1.00092	0.01391	0.03621	0.09639	-0.1444+01
4	4	5.225	-16.875	0.233	0.1091	1.7737	-0.14609	-0.00182	0.97910	-0.00308	-0.02710	0.23280	-0.2084+01
5	1	-1.992	-13.125	0.000	0.90009	1.4015	0.08811	0.00551	1.000628	0.00940	0.04241	-0.00113	-0.1846+01
5	2	0.664	-13.125	0.000	0.90009	1.1430	-0.00355	0.00007	1.000674	0.01129	0.02523	0.09070	-0.1508+01
5	3	3.320	-13.125	0.000	0.90009	1.3289	-0.02116	0.00220	1.001754	0.02737	0.06497	0.08483	-0.1725+01
5	4	5.888	-13.125	0.332	0.90009	2.1637	-0.21901	-0.00619	0.97864	-0.00911	-0.05307	0.30509	-0.2886+01
6	1	-2.227	-9.375	0.000	0.10120	1.6506	0.13776	0.00817	1.000433	0.00822	0.02996	-0.04386	-0.2435+01
6	2	0.742	-9.375	0.000	0.10120	1.1634	0.00965	0.00012	1.000690	0.01128	0.01716	0.08151	-0.1715+01
6	3	3.711	-9.375	0.000	0.10120	1.2680	-0.02104	0.00219	1.001675	0.02820	0.07125	0.10830	-0.1838+01
6	4	6.580	-9.375	0.371	0.10120	2.1333	-0.22464	-0.00500	0.97573	-0.01001	-0.04035	0.31192	-0.3190+01
7	1	-2.401	-5.625	0.000	0.20047	1.6194	0.12925	0.00808	1.000469	0.00840	0.03291	-0.04234	-0.2639+01
7	2	0.820	-5.625	0.000	0.20047	1.1461	0.00319	0.00007	1.000723	0.01175	0.02384	0.08396	-0.1866+01
7	3	4.102	-5.625	0.000	0.20047	1.2550	-0.02213	0.00230	1.001616	0.02870	0.07185	0.10940	-0.2013+01
7	4	7.273	-5.625	0.410	0.20047	2.1350	-0.22167	-0.00523	0.97304	-0.00957	-0.02077	0.31074	-0.3538+01
8	1	-2.695	-1.875	0.000	0.104700	1.3190	0.06572	0.00411	1.000625	0.01089	0.01800	0.02131	-0.2352+01
8	2	0.898	-1.875	0.000	0.104700	1.1612	0.00027	0.00016	1.000834	0.01265	0.01376	0.08888	-0.2069+01
8	3	4.492	-1.875	0.000	0.104700	1.3602	-0.00131	0.00037	1.001672	0.02985	0.00782	0.10036	-0.2324+01
8	4	7.966	-1.875	0.449	0.104700	2.1700	-0.21373	-0.00609	0.97380	-0.00682	-0.00857	0.30380	-0.3937+01
9	1	-2.695	1.875	0.000	0.104700	1.3423	0.06910	0.00432	1.000608	0.01081	0.01657	0.07192	-0.2393+01
9	2	0.898	1.875	0.000	0.104700	1.1693	0.00079	0.00002	1.000824	0.01257	0.01450	0.08637	-0.2083+01
9	3	4.492	1.875	0.000	0.104700	1.3301	-0.001294	0.000135	1.001933	0.02978	0.01083	0.10017	-0.2332+01
9	4	7.966	1.875	0.449	0.104700	2.1670	-0.21245	0.00662	0.97198	-0.00701	-0.00763	0.30346	-0.3939+01

JOHFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
 VALUE 1 0 16 0 1 4 0 1 0 4 ALPHA= 3.00 MACHNO= .2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=\*\*\*\*\* 7

J	K	P(X)	P(Y)	P(Z)	AREA	CPA	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
10	1	-2.401	5.625	0.000	0.20047	1.7737	0.14609	-0.00879	1.000433	0.00811	-0.03168	-0.05372	-0.2773+01
10	2	0.820	5.625	0.000	0.20047	1.1727	0.00997	0.00010	1.000692	0.01146	-0.02492	0.08219	-0.1910+01
10	3	4.102	5.625	0.000	0.20047	1.2671	-0.02129	0.00222	1.001754	0.02845	-0.01537	0.10850	-0.2032+01
10	4	7.273	5.625	0.410	0.20047	2.1325	-0.21944	-0.00530	0.97362	-0.01721	-0.00951	0.30953	-0.3543+01
11	1	-2.227	9.375	0.000	0.10120	1.6310	0.15552	0.00972	1.000361	0.00758	0.02875	-0.06867	-0.2703+01
11	2	0.742	9.375	0.000	0.10120	1.1617	0.00006	0.00012	1.000622	0.01063	0.01896	0.07709	-0.1795+01
11	3	3.711	9.375	0.000	0.10120	1.2826	-0.00182	0.000194	1.001768	0.02764	0.00725	0.10588	-0.1861+01
11	4	6.580	9.375	0.371	0.10120	2.1275	-0.22111	0.00524	0.97216	-0.01122	-0.02541	0.30974	-0.3193+01
12	1	-1.992	13.125	0.000	0.90009	1.8064	0.14688	-0.00918	1.000410	0.00775	-0.03380	-0.06001	-0.2385+01
12	2	0.664	13.125	0.000	0.90009	1.2385	0.00793	0.00017	1.000573	0.01723	-0.02138	0.07722	-0.1635+01
12	3	3.320	13.125	0.000	0.90009	1.3232	-0.00734	0.000181	1.001693	0.02686	-0.00597	0.10459	-0.1719+01
12	4	5.888	13.125	0.332	0.90009	2.1410	-0.21810	0.00584	0.97340	-0.01152	-0.03502	0.30577	-0.2972+01
13	1	-1.758	16.875	0.000	0.1091	1.7364	0.13505	-0.00844	1.000483	0.00730	-0.02886	-0.04410	-0.2722+01
13	2	0.580	16.875	0.000	0.1091	1.2167	0.00794	0.00017	1.000315	0.00796	-0.03768	0.07921	-0.1621+01
13	3	2.931	16.875	0.000	0.1091	1.2827	-0.00102	0.00015	1.000827	0.01976	-0.02143	0.09324	-0.1482+01
13	4	5.279	16.875	0.267	0.1091	1.9630	-0.18703	0.00743	0.97411	-0.00921	-0.02739	0.27665	-0.2321+01
14	1	-1.523	20.625	0.000	1.0012	2.4350	0.29157	-0.01622	0.99539	-0.00146	-0.04161	-0.27491	-0.2480+01
14	2	0.508	20.625	0.000	1.0012	1.0037	0.04128	0.00086	0.99649	0.00109	-0.02813	0.04586	-0.1957+01
14	3	2.539	20.625	0.000	1.0012	1.2203	-0.00196	0.00020	0.99594	0.00258	-0.01385	0.10519	-0.2362+01
14	4	4.557	20.625	0.114	1.0012	0.9794	-0.00707	0.00254	0.97774	-0.00552	-0.02029	0.18449	-0.1001+01
15	1	-1.289	24.375	0.000	0.4433	2.0224	0.22491	-0.01406	0.99512	-0.00005	-0.01467	-0.13819	-0.1743+01
15	2	0.430	24.375	0.000	0.4433	0.9444	0.03329	0.00069	0.99626	0.00038	-0.00487	0.03386	-0.0149+00

## 6.3 EXAMPLE PROBLEM # 2, SINGLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

15	3	2.148	24.375	.000	0.4455	.6917	.00864	.00090	.99439	.00244	.00605	.07847	-.5946+00
15	4	3.861	24.375	.075	0.4455	.8318	-.06429	.02005	.98029	-.00353	.02554	.15173	-.7167+00
16	1	-1.055	28.125	.000	0.2734	1.4994	.15883	-.00993	.99632	.00125	-.01310	-.07198	-.1056+01
16	2	.352	28.125	.000	0.2734	.7532	.02289	.00048	.99731	.00140	-.00333	.06426	-.5309+00
16	3	1.758	28.125	.000	0.2734	.5929	.00547	.00057	.99454	.00297	.00725	.08165	-.4169+00
16	4	3.160	28.125	.052	0.2734	.7185	-.05405	.02202	.98285	-.00088	.02528	.14133	-.5052+00

SECTION LIFT COEFFICIENTS  
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J	2Y/H	Y	L	SCL	SCLC/B	DLIFT	SCMIC/41	IXL	IYL	IZL
1	-.9375	-28.125	0.000	.2257	.0212	.0079	.1592	-.2090	.0039	-.9779
2	-.8125	-24.375	0.075	.1588	.0436	.0164	.2064	-.2882	-.0078	-.9575
3	-.6875	-20.625	0.140	.0738	.0995	.0373	.2109	-.4021	-.0351	-.9149
4	-.5625	-16.875	0.205	1.2801	.2000	.0750	-.3138	.0488	.0319	-.9983
5	-.4375	-13.125	0.260	1.5128	.2679	.1005	-.3603	.0650	.0188	-.9977

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALPHA= 5.00 MACHNO= .2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=\*\*\*\*\* 8

J	2Y/B	Y	L	SCL	SCLC/B	DLIFT	SCMIC/41	IXL	IYL	IZL
6	-.3125	-9.375	11.075	1.5560	.3380	.1155	-.3400	.0476	.0167	-.9987
7	-.1875	-5.625	13.140	1.3411	.3371	.1264	-.3403	.0489	.0171	-.9987
8	-.0625	-1.875	14.375	1.4982	.3590	.1346	-.3652	.0679	.0199	-.9975
9	.0625	1.875	14.375	1.3059	.3608	.1353	-.3661	.0660	-.0197	-.9976
10	.1875	5.625	13.140	1.5699	.3434	.1288	-.3375	.0422	-.0166	-.9990
11	.3125	9.375	11.075	1.0155	.3197	.1199	-.3326	.0327	.0156	-.9993
12	.4375	13.125	10.000	1.0286	.2884	.1082	-.3392	.0351	-.0160	-.9993
13	.5625	16.875	9.375	1.5505	.2423	.0909	-.3139	.0239	-.0207	-.9995
14	.6875	20.625	8.140	1.3050	.1767	.0663	-.0965	-.1265	-.0018	-.9920
15	.8125	24.375	6.875	1.1281	.1293	.0485	-.0910	-.0975	.0023	-.9952
16	.9375	28.125	5.600	.6927	.0837	.0314	-.0888	-.0616	-.0005	-.9981

CHORDWISE PRESSURE DISTRIBUTION DETAIL  
\*\*\*\*\*

2Y/B	SCL	CHORD STATION (X-XLE)/C	CHORD PRESSURE (CPL -CPU)*IZL
-.9375	.22344	.00000	1.14720
-.8125	.37276	.10000	1.65430
-.6875	.69553	.20000	2.38180
-.5625	1.26758	.30000	1.05074
-.4375	1.49499	.40000	1.36320
-.3125	1.54170	.50000	1.57340
-.1875	1.52661	.60000	1.54483
-.0625	1.47994	.70000	1.30167
.0625	1.48758	.80000	1.32153
.1875	1.55654	.90000	1.61640
.3125	1.60371	1.00000	1.73140
.4375	1.61626	1.10000	1.71431
.5625	1.54065	1.20000	1.65218
.6875	1.30395	1.30000	1.65218
.8125	1.12801	1.40000	1.83631
.9375	.89240	1.50000	1.37075

(EOF PLOT FILE 2) FILE # 2 = CHORDWISE PRESSURE DISTRIBUTION  
(VORTEX-LATTICE SOLUTION)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALPHA= 5.00 MACHNO= .2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=\*\*\*\*\* 9

SPANWISE SECTION LIFT DISTRIBUTION DETAIL  
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Y	2Y/B	SCL	SCLD	SCMIC/41	SCL	SCLD	SCMIC/41	FCN	FCX	FCY
-30.000	-1.00000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
-28.500	-.950000	.211350	-.000000	.157826	.255351	.021873	.169923	-.667522	.065703	.166881
-27.000	-.900000	.262320	-.000000	.163420	.304245	.027894	.174946	-.697576	.057773	.174394
-25.500	-.850000	.319920	-.000000	.179243	.379079	.034834	.195508	-.752306	.115413	.188077
-24.000	-.800000	.392975	-.000000	.218600	.513978	.043915	.251866	-.863516	.059693	.215879
-22.500	-.750000	.494723	-.000000	.264024	.712633	.057087	.323933	-.954174	.054842	.238544
-21.000	-.700000	.646929	-.000000	.323232	.919462	.077707	.313158	-.735710	.030169	.183928
-19.500	-.650000	.865756	-.000000	.407602	1.078728	.108538	.131153	-.044270	.073506	-.011067
-18.000	-.600000	1.110709	.007710	.516626	1.192642	.145766	-.143566	1.111887	.174742	-.277972
-16.500	-.550000	1.399547	.201715	.642695	1.293113	.182199	-.347213	1.924460	.254011	-.481115
-15.000	-.500000	1.426180	.240504	.638715	1.394953	.211302	-.396460	2.202364	.358997	-.550591
-13.500	-.450000	1.485347	.250000	.636598	1.479298	.227870	-.365261	2.181211	.472564	-.545303
-12.000	-.400000	1.517628	.217699	.630768	1.526280	.227974	-.338886	2.132749	.502763	-.533187
-10.500	-.350000	1.535604	.211044	.633373	1.541010	.217465	-.333886	2.134788	.489267	-.533697
-9.000	-.300000	1.542580	.200000	.633536	1.541399	.204129	-.335681	2.133996	.486293	-.533499
-7.500	-.250000	1.540784	.200790	.633684	1.538536	.207580	-.334834	2.133683	.486500	-.533421
-6.000	-.200000	1.530501	.200000	.634714	1.530064	.207196	-.341869	2.143509	.484550	-.535877
-4.500	-.150000	1.512358	.210000	.634204	1.512293	.215817	-.353167	2.160066	.479888	-.540017
-3.000	-.100000	1.491912	.220130	.635280	1.492323	.225626	-.362381	2.173242	.475508	-.543310
-1.500	-.050000	1.477241	.230100	.636253	1.477140	.235250	-.365228	2.176532	.473209	-.544133
.000	.000000	1.474079	.230041	.636516	1.473834	.237158	-.361501	2.170549	.473377	-.542637
1.500	.050000	1.483564	.231847	.636180	1.483689	.227633	-.351824	2.157114	.476057	-.539278
3.000	.100000	1.505680	.220000	.634997	1.505278	.217748	-.340001	2.141458	.479846	-.535365
4.500	.150000	1.534928	.210000	.633185	1.535278	.206400	-.331449	2.130541	.482603	-.532635
6.000	.200000	1.563015	.200000	.630871	1.563015	.194469	-.328635	2.127422	.483403	-.531856
7.500	.250000	1.584665	.190000	.628312	1.584392	.193047	-.328280	2.127567	.483688	-.531892
9.000	.300000	1.600592	.180000	.626111	1.599889	.193047	-.327170	2.126671	.484741	-.531668
10.500	.350000	1.611695	.170000	.624201	1.614407	.193047	-.327170	2.126671	.484741	-.531668

## 6.3 EXAMPLE PROBLEM # 2, SINGLE SURFACE ANALYSIS CAPABILITY (CONTINUED)

12.000	.400000	1.617052	.193449	-.329650	1.021535	.198772	-.328417	2.130054	.484090	-.532514
13.500	.450000	1.614868	.201376	-.337417	1.011735	.197851	-.333279	2.147656	.477286	-.536914
15.000	.500000	1.599256	.209224	-.344630	1.583782	.197016	-.349077	2.149363	.455048	-.537341
16.500	.550000	1.557017	.180273	-.323676	1.548505	.176166	-.326018	2.027192	.350729	-.506798
18.000	.600000	1.477211	.100703	-.253486	1.520269	.157898	-.238651	1.688015	.253743	-.422704
19.500	.650000	1.375936	.003901	-.152782	1.490074	.138966	-.121422	1.245876	.179199	-.311469
21.000	.700000	1.283082	-.060714	-.084713	1.438798	.124210	-.041903	.927555	.080987	-.230139
22.500	.750000	1.212442	-.050027	-.072307	1.357426	.115552	-.032528	.819186	.051487	-.204797
24.000	.800000	1.146327	-.020610	-.087016	1.255644	.109213	-.056962	.828420	.053268	-.207107
25.500	.850000	1.065549	.007100	-.096447	1.144798	.101167	-.074684	.821118	.054492	-.205280
27.000	.900000	.969372	.010970	-.094144	1.029976	.090884	-.077502	.770320	.047431	-.192580
28.500	.950000	.866540	.023517	-.086750	.913453	.079632	-.073852	.730636	.026163	-.175159
30.000	1.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000

LEOF PLOT FILE 31 FILE # 3 = LIFT, INDUCED DRAG, AND PITCHING MOMENT SECTION COEFFICIENTS  
(VORTEX-LATTICE SOLUTION)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 10 0 1 4 0 1 0 4 ALPHA= 5.00 MACIND= .2000 FLAP= 30.00 AILERON= 10.00-15.00 ALTITUDE=\*\*\*\*\* 10

WING AIRLOAD COEFFICIENTS  
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	WCL	WCLT	WCLP	WCLR	WCLY	IXL	IYL	I2L	DELTA	SCALE
WITH LE SUCTION	1.32943	.13547	-.27100	.04228	-.00086	.014089	-.000498	-.599901	.4971+35	.1661-01
NO LE SUCTION	1.39743	.21546	-.259405	.04171	-.00028	.066015	.000000	-.997819		

\* DIVIDE CHECK AT C41425 }  
\* DIVIDE CHECK AT C41425 } OK TO IGNORE

LINEARIZED SOLUTION WITH LE SUCTION  
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ALFA	ALFARU	WCL	WCL SLOPE	CMP SLOPE	CMR SLOPE	CMY
5.000	-11.009	1.3294	.07886	.00022	.00004	.00005

Y	ZY/B	SCLA1	SCLB	SCL	SCM(1/4)
-30.000	-1.00000	.00000	.00000	.00000	.00000
-28.000	-.95533	.91864	-.99078	.23049	.15013
-26.000	-.80067	1.00414	-1.03309	.30184	.16816
-24.000	-.60000	1.00436	-1.01915	.39585	.21579
-22.000	-.40000	1.00552	-.97133	.54179	.25888
-20.000	-.20000	1.07772	-.64552	.78630	.12274
-18.000	-.00000	1.00536	-.29957	1.10305	-.19570
-16.000	.20000	1.00412	-.03879	1.34531	-.39282
-14.000	.40000	1.03895	.07693	1.45814	-.37730

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 10 0 1 4 0 1 0 4 ALPHA= 5.00 MACIND= .2000 FLAP= 30.00 AILERON= 10.00-15.00 ALTITUDE=\*\*\*\*\* 11

Y	ZY/B	SCLA1	SCLB	SCL	SCM(1/4)
-12.000	-.40000	1.003153	.13490	1.50624	-.33419
-10.000	-.20000	1.01472	.17054	1.52754	-.32886
-8.000	-.00000	.99550	.27737	1.53082	-.31640
-6.000	.20000	.97205	.22677	1.51904	-.30483
-4.000	.40000	.93920	.24520	1.49391	-.32902
-2.000	.60000	.91801	.26150	1.46944	-.36917
.000	.80000	.80622	.27103	1.46240	-.38720
2.000	1.00000	.90675	.27261	1.47807	-.37145
4.000	1.20000	.90708	.26798	1.51337	-.32912
6.000	1.40000	.90977	.26226	1.55150	-.30330
8.000	1.60000	.97244	.25959	1.57897	-.31710
10.000	1.80000	1.01131	.25239	1.59686	-.33131
12.000	2.00000	1.00966	.23658	1.60544	-.32956
14.000	2.20000	1.00402	.21469	1.59999	-.34663
16.000	2.40000	1.00083	.16639	1.56239	-.35687
18.000	2.60000	1.00745	.04786	1.46749	-.26597
20.000	2.80000	1.00815	-.11108	1.33554	-.11839
22.000	3.00000	1.00204	-.22383	1.22675	-.06490
24.000	3.20000	1.00736	-.27817	1.14080	-.09538
26.000	3.40000	1.00471	-.30017	1.02952	-.11147
28.000	3.60000	.91814	-.32425	.89636	-.10768
30.000	3.80000	.00000	.00000	.00000	.00000

ORIGINAL PAGE IS  
OF POOR QUALITY

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 10 0 1 4 0 1 0 4 ALPHA= 5.00 MACIND= .2000 FLAP= 30.00 AILERON= 10.00-15.00 ALTITUDE=\*\*\*\*\* 12

LINEARIZED SOLUTION WITH LE SUCTION  
\*\*\*\*\*

ALFA	ALFARU	WCL	WCL SLOPE	CMP SLOPE	CMR SLOPE	CMY
-11.854	-11.009	.7000	.07886	.00022	.00004	.00005

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 10 0 1 4 0 1 0 4 ALPHA= 5.00 MACIND= .2000 FLAP= 30.00 AILERON= 10.00-15.00 ALTITUDE=\*\*\*\*\* 13

LINEARIZED SOLUTION WITH LE SUCTION  
\*\*\*\*\*

## 6.3 EXAMPLE PROBLEM # 2, SINGLE-SURFACE ANALYSIS CAPABILITY (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALPHA= 3.00 MACHNO= .2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=\*\*\*\*\* 16

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALPHA= 3.00 MACHNO= .2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=\*\*\*\*\* 20

## LINEARIZED SOLUTION WITH LE SUCTION

ALFA	ALFAKO	WCL	WCL SLOPE	CMR SLOPE	CMR SLOPE	CMY
13.503	-11.029	2.0000	.07886	.00022	.00004	.00005

## WITH LE SUCTION

## NO LE SUCTION

## FLAP/AILERON

Y	2Y/B	SCL	SCDI	SCM(C/4)	SCL	SCDI	SCM(C/4)	FCN	FCX	FCM
-30.000	-1.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
-28.000	-.933333	.866498	.000000	.161354	.948306	.179898	.189343	-.509958	.021626	.127490
-26.000	-.866667	.975183	.000000	.171091	1.091802	.201369	.203150	-.548887	.056085	.137222
-24.000	-.800000	1.109572	.000000	.216524	1.398895	.400929	.296068	-.662415	.028898	.165604
-22.000	-.733333	1.269711	.072117	.267835	1.861343	.753473	.430532	-.715877	-.039961	.178969
-20.000	-.666667	1.508509	.103557	.151275	2.100056	.783859	.314267	-.110440	.045348	.027610
-18.000	-.600000	1.810541	.103557	-.146758	2.003084	.388527	-.093422	1.157260	.358593	-.289315
-16.000	-.533333	2.043458	.223100	-.350218	1.9465215	.136478	-.371362	2.039362	.663232	-.509841
-14.000	-.466667	2.154820	.203140	-.364573	2.115328	.205799	-.375333	2.173559	.844779	-.543390
-12.000	-.400000	2.197950	.203140	-.335930	2.219985	.292431	-.329923	2.109684	.908632	-.527421
-10.000	-.333333	2.207985	.203140	-.330483	2.215269	.295625	-.328498	2.106126	.900286	-.526531
-8.000	-.266667	2.198371	.303293	-.335216	2.192240	.298401	-.336887	2.128665	.891915	-.532166
-6.000	-.200000	2.170860	.303293	-.341592	2.169746	.321727	-.341896	2.143098	.853877	-.535774
-4.000	-.133333	2.123763	.344943	-.345769	2.125430	.346816	-.345315	2.126333	.882309	-.531583
-2.000	-.066667	2.078726	.344943	-.346873	2.078827	.364948	-.346845	2.093673	.843206	-.523418
.000	.000000	2.063465	.343843	-.345593	2.062856	.373147	-.345759	2.074288	.852506	-.518572
2.000	.066667	2.086115	.303000	-.344100	2.086180	.369683	-.344082	2.083681	.856071	-.520920
4.000	.133333	2.141754	.353343	-.343153	2.142637	.354385	-.342911	2.119630	.872627	-.529907
6.000	.200000	2.201798	.344843	-.331378	2.201248	.334192	-.337529	2.135381	.864108	-.533845
8.000	.266667	2.244474	.341002	-.325435	2.241490	.318140	-.326255	2.107132	.879660	-.526783
10.000	.333333	2.275009	.303000	-.318168	2.278538	.313152	-.317198	2.084673	.875953	-.521168
12.000	.400000	2.295901	.294400	-.321529	2.306565	.306765	-.318597	2.096136	.877257	-.524034
14.000	.466667	2.298736	.201300	-.323975	2.279881	.258726	-.335214	2.114841	.861008	-.528710
16.000	.533333	2.268043	.201300	-.316765	2.232036	.221972	-.326664	2.041261	.783673	-.510315
18.000	.600000	2.183553	.201300	-.236987	2.285982	.351015	-.207927	1.712967	.585816	-.428242
20.000	.666667	2.065214	.100000	-.122818	2.382999	.566088	-.035451	1.257704	.339441	-.314426
22.000	.733333	1.961440	.100000	-.072108	2.325266	.599061	.027916	1.015716	.212299	-.254929
24.000	.800000	1.856542	.100000	-.079648	2.116473	.474832	.008186	.985184	.156913	-.246296
26.000	.866667	1.703253	.171547	-.086085	1.874422	.380624	-.039026	.942345	.187464	-.235586
28.000	.933333	1.512038	.107200	-.087875	1.634103	.332212	-.047316	.855400	.161215	-.213850
30.000	1.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000

WITH LE SUCTION WCL= 2.00000 / WCDI= .25831 / WCM(C/4)= -.26917 / L/D= 7.74255  
NO LE SUCTION 2.10041 / .42297 / -.22422 / 5.15497

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE  
VALUE 1 0 16 0 1 4 0 1 0 4 ALPHA= 3.00 MACHNO= .2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=\*\*\*\*\* 21

## LINEARIZED SOLUTION WING COEFFICIENTS

## WITH LE SUCTION

## NO LE SUCTION

ALFA	WCL	WCD	WCM(C/4)	WCL	WCD	WCM(C/4)
-12.000	-.0112	.0156	-.2749	-.0222	.0299	-.2810
-11.000	-.0077	.0162	-.2747	.0469	.0307	-.2808
-10.000	-.0040	.0175	-.2744	.1266	.0326	-.2803
-9.000	-.0000	.0196	-.2742	.2070	.0358	-.2797
-8.000	.0043	.0224	-.2740	.2879	.0402	-.2790
-7.000	.0081	.0260	-.2738	.3695	.0458	-.2780
-6.000	.0120	.0303	-.2735	.4517	.0526	-.2770
-5.000	.0160	.0354	-.2733	.5346	.0607	-.2757
-4.000	.0197	.0412	-.2731	.6181	.0700	-.2743
-3.000	.0230	.0478	-.2729	.7021	.0805	-.2728
-2.000	.0274	.0551	-.2726	.7869	.0922	-.2711
-1.000	.0320	.0632	-.2724	.8722	.1051	-.2692
.000	.0361	.0721	-.2722	.9582	.1193	-.2672
1.000	.0400	.0817	-.2720	1.0448	.1347	-.2650
2.000	.0434	.0920	-.2718	1.1320	.1513	-.2626
3.000	.0471	.1032	-.2715	1.2198	.1691	-.2601
4.000	.0500	.1150	-.2713	1.3083	.1881	-.2575
5.000	.0534	.1276	-.2711	1.3974	.2084	-.2547
6.000	.0560	.1410	-.2709	1.4872	.2299	-.2517
7.000	.0581	.1551	-.2706	1.5775	.2526	-.2485
8.000	.0600	.1700	-.2704	1.6685	.2765	-.2452
9.000	.0614	.1856	-.2702	1.7601	.3016	-.2418
10.000	.0627	.2020	-.2700	1.8523	.3280	-.2382
11.000	.0630	.2191	-.2697	1.9452	.3556	-.2344
12.000	.0634	.2370	-.2695	2.0387	.3844	-.2304
13.000	.0630	.2556	-.2693	2.1328	.4144	-.2263
14.000	.0614	.2750	-.2691	2.2275	.4456	-.2221
15.000	.0581	.2952	-.2688	2.3229	.4781	-.2177
16.000	.0534	.3161	-.2686	2.4189	.5118	-.2131
17.000	.0471	.3377	-.2684	2.5155	.5467	-.2084
18.000	.0390	.3601	-.2682	2.6127	.5828	-.2035

(EOF PLT FILE 41) FILE # 3 = LINEARIZED SOLUTION ARRAY (EXTRAPOLATED USING LIFTING-LINE THEORY)

\*\*\*\* JOB TIME= 133 / ELAPSED TIME= 133 / NO.PLOT FILES= 4 / ISURF EXEC. VERSION 6-18-72 \*\*\*\*

XQT TRMPLT OUTPUT OMITTED, SEE INPUT LISTINGS (PAGE 6-3 THROUGH 6-5)



## 6.4 EXAMPLE PROBLEM # 3, NORTH AMERICAN XB-70 AIRPLANE (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE  
 VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 2

LIFTING SURFACE NO# 1  
 \*\*\*\*\*

SURFACE # 1 = WING

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MGC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
104.995	117.756	2.200	.0000	-3.0000	6196.66	1.7790	59.019	76.777	17.943	-59.772	.970
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	LAILE DEFLEC	RAILE DEFLEC	DIMED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.600	1.000	.000	.000	.000	.000	.000	58.795	22	6	0
FUS STA X(CG)	WING STA Y(CG)	HL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)						
-60.491	.000	.458	6297.748	78.931	105.000						
WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-52.498	-52.497	.000	-2.200	-1.650	.000	-3.000	.000	-58.795	2.200	.550	.275
-47.246	-47.247	.000	-13.756	-10.317	.000	-3.000	.000	-58.795	13.756	3.439	1.719
-41.999	-41.998	.000	-25.312	-18.984	.000	-3.000	.000	-58.795	25.312	6.328	3.164
-36.749	-36.748	.000	-36.867	-27.651	.000	-3.000	.000	-58.795	36.867	9.217	4.608
-31.499	-31.498	.000	-48.423	-36.317	.000	-2.800	.000	-58.795	48.423	12.106	6.053
-26.249	-26.248	.000	-59.979	-44.984	.000	-2.250	.000	-58.795	59.979	14.998	7.497
-20.999	-20.998	.000	-71.535	-53.651	.000	-1.700	.000	-58.795	71.535	17.884	8.942
-15.749	-15.748	.051	-83.090	-63.054	.000	-1.150	.000	-61.876	80.144	20.036	10.018
-10.500	-10.499	.044	-94.645	-72.036	.000	-2.846	.000	-58.795	90.437	22.609	11.308
-5.250	-5.250	.004	-106.075	-82.109	.000	-4.208	.000	-44.1	-63.185	103.867	25.967
.000	.000	.000	-121.965	-92.525	.000	-4.208	.000	.000	63.260	117.756	29.439
5.250	5.250	.004	-106.075	-82.109	.000	-4.208	.000	-44.1	63.185	103.867	25.967
10.500	10.499	.044	-94.645	-72.036	.000	-4.208	.000	-44.1	58.795	90.437	22.609
15.749	15.748	.051	-83.090	-63.054	.000	-2.846	.000	.882	61.876	80.144	20.036
20.999	20.998	.000	-71.535	-53.651	.000	-1.700	.000	58.795	71.535	17.884	8.942
26.249	26.248	.000	-59.979	-44.984	.000	-2.250	.000	58.795	59.979	14.998	7.497
31.499	31.498	.000	-48.423	-36.317	.000	-2.800	.000	58.795	48.423	12.106	6.053
36.749	36.748	.000	-36.867	-27.651	.000	-3.000	.000	58.795	36.867	9.217	4.608
41.999	41.998	.000	-25.312	-18.984	.000	-3.000	.000	58.795	25.312	6.328	3.164
47.248	47.247	.000	-13.756	-10.317	.000	-3.000	.000	58.795	13.756	3.439	1.719
52.498	52.497	.000	-2.200	-1.650	.000	-3.000	.000	58.795	2.200	.550	.275

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE  
 VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 3

X	Y	Z	X(1)/C	X(2)/C	X(3)/C	X(4)/C	X(5)/C	X(6)/C	X(7)/C	X(8)/C	X(9)/C	X(10)/C
-4.2083	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
-4.2083	4.7725	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
-4.2083	9.5450	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
-4.2083	14.3174	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	19.0899	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	33.8674	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	52.4973	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

(EOF PLOT FILE 1) FILE # 1 = WING GEOMETRY

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE  
 VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 4

LIFTING SURFACE NO# 2  
 \*\*\*\*\*

SURFACE # 2 = CANARD CONTROL SURFACE

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MGC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
28.635	20.792	8.059	3.0000	3.0000	413.07	1.9850	14.425	15.362	6.106	-147.385	-6.256
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	LAILE DEFLEC	RAILE DEFLEC	DIMED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.600	1.000	.000	.000	.000	.000	.000	21.746	6	2	0
FUS STA X(CG)	WING STA Y(CG)	HL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)						
-60.491	.000	.458	6297.748	78.931	105.000						
WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-14.317	-14.317	-6.083	-146.124	-144.109	-138.065	3.000	.000	-21.746	8.059	2.015	1.007
-12.866	-12.866	-6.083	-147.013	-144.680	-137.681	3.000	.000	-21.746	9.332	2.333	1.167
-11.454	-11.454	-6.083	-147.903	-145.251	-137.297	3.000	.000	-21.746	10.606	2.651	1.326
-10.022	-10.022	-6.083	-148.792	-145.822	-136.913	3.000	.000	-21.746	11.879	2.970	1.485
-8.590	-8.590	-6.083	-149.682	-146.394	-136.530	3.000	.000	-21.746	13.152	3.288	1.644
-7.159	-7.159	-6.083	-150.571	-146.965	-136.146	3.000	.000	-21.746	14.425	3.606	1.803
-5.727	-5.727	-6.083	-151.460	-147.536	-135.762	3.000	.000	-21.746	15.699	3.925	1.962
-4.295	-4.295	-6.083	-152.350	-148.107	-135.378	3.000	.000	-21.746	16.972	4.243	2.121
-2.863	-2.863	-6.083	-153.239	-148.678	-134.994	3.000	.000	-21.746	18.245	4.561	2.281
-1.432	-1.432	-6.083	-154.129	-149.249	-134.610	3.000	.000	-21.746	19.518	4.880	2.440
.000	.000	-6.083	-155.018	-149.820	-134.227	3.000	-6.610	-70.370	20.792	5.198	2.599
1.432	1.432	-6.083	-154.129	-149.249	-134.610	3.000	.000	21.746	19.518	4.880	2.440
2.863	2.863	-6.083	-153.239	-148.678	-134.994	3.000	.000	21.746	18.245	4.561	2.281
4.295	4.295	-6.083	-152.350	-148.107	-135.378	3.000	.000	21.746	16.972	4.243	2.121

6.4 EXAMPLE PROBLEM # 3, NORTH AMERICAN XB-70 AIRPLANE (CONTINUED)

5.727	5.727	-6.083	-151.460	-147.936	-135.762	3.000	.000	21.746	15.699	3.929	1.962
7.159	7.159	-6.083	-150.571	-146.965	-136.146	3.000	.000	21.746	14.425	3.608	1.803
8.590	8.590	-6.083	-149.682	-146.394	-135.530	3.000	.000	21.746	13.152	3.288	1.644
10.022	10.022	-6.083	-148.792	-145.822	-134.913	3.000	.000	21.746	11.879	2.970	1.485
11.454	11.454	-6.083	-147.903	-145.251	-134.297	3.000	.000	21.746	10.606	2.651	1.326
12.886	12.886	-6.083	-147.013	-144.680	-133.681	3.000	.000	21.746	9.332	2.333	1.167
14.317	14.317	-6.083	-146.124	-144.109	-133.065	3.000	.000	21.746	8.059	2.015	1.007

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 5

XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
.0000	.5000	1.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
-143.5828	.0000	.0000	.0000	.0882	.0000	.0000	.0000	.0000	.0000	.0000	.0000
-143.5828	14.3174	.0000	.0000	.0882	.0000	.0000	.0000	.0000	.0000	.0000	.0000

(EOF PLOT FILE 2) FILE # 2 = CANARD CONTROL SURFACE GEOMETRY

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 6

LIFTING SURFACE NO= 3  
\*\*\*\*\*  
SURFACE # 3 = FUSELAGE

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
9.545	61.666	53.333	.0000	.0000	548.83	1.660	57.500	57.600	2.329	-158.981	.000
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	LAIL DEFLEC	RAIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	ZO.CHORD DISCONT.
.000	.600	1.000	.000	.000	.000	.000	.000	75.784	2	3	0
FUS STA X(CG)	WING STA Y(CG)	HL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)						
-60.491	.000	.458	6297.748	78.931	105.000						

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHED(C/4)	SWEEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-4.772	-4.772	.000	-162.668	-149.334	-109.334	.000	.000	-75.784	53.333	13.333	6.667
-4.295	-4.295	.000	-164.760	-151.218	-110.593	.000	.000	-75.784	54.166	13.542	6.771
-3.818	-3.818	.000	-166.852	-153.102	-111.852	.000	.000	-75.784	55.000	13.750	6.875
-3.341	-3.341	.000	-168.944	-154.986	-113.111	.000	.000	-75.784	55.833	13.958	6.979
-2.863	-2.863	.000	-171.036	-156.870	-114.370	.000	.000	-75.784	56.666	14.167	7.083
-2.386	-2.386	.000	-173.128	-158.753	-115.629	.000	.000	-75.784	57.500	14.375	7.187
-1.909	-1.909	.000	-175.221	-160.637	-116.887	.000	.000	-75.784	58.333	14.583	7.292
-1.432	-1.432	.000	-177.313	-162.521	-118.146	.000	.000	-75.784	59.166	14.792	7.396
-.954	-.954	.000	-179.405	-164.405	-119.405	.000	.000	-75.784	60.000	15.000	7.500
-.477	-.477	.000	-181.497	-166.289	-120.664	.000	.000	-75.784	60.833	15.208	7.604
.000	.000	.000	-183.589	-168.173	-121.923	.000	.000	-57.119	61.666	15.417	7.708
.477	.477	.000	-181.497	-166.289	-120.664	.000	.000	75.784	60.833	15.208	7.604
.954	.954	.000	-179.405	-164.405	-119.405	.000	.000	75.784	60.000	15.000	7.500
1.432	1.432	.000	-177.313	-162.521	-118.146	.000	.000	75.784	59.166	14.792	7.396
1.909	1.909	.000	-175.221	-160.637	-116.887	.000	.000	75.784	58.333	14.583	7.292
2.386	2.386	.000	-173.128	-158.753	-115.629	.000	.000	75.784	57.500	14.375	7.187
2.863	2.863	.000	-171.036	-156.870	-114.370	.000	.000	75.784	56.666	14.167	7.083
3.341	3.341	.000	-168.944	-154.986	-113.111	.000	.000	75.784	55.833	13.958	6.979
3.818	3.818	.000	-166.852	-153.102	-111.852	.000	.000	75.784	55.000	13.750	6.875
4.295	4.295	.000	-164.760	-151.218	-110.593	.000	.000	75.784	54.166	13.542	6.771
4.772	4.772	.000	-162.668	-149.334	-109.334	.000	.000	75.784	53.333	13.333	6.667

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 7

XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
.0000	1.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
-121.9228	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
-109.3344	4.7725	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

(EOF PLOT FILE 3) FILE # 3 = FUSELAGE GEOMETRY

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 8

LIFTING SURFACE NO= 4  
\*\*\*\*\*  
SURFACE # 4 = VERTICAL FIN

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
14.391	27.344	6.922	-1.0000	-1.0000	246.56	.8399	17.133	19.182	14.317	-15.691	-5.442



## 6.4 EXAMPLE PROBLEM # 3, NORTH AMERICAN XB-70 AIRPLANE (CONTINUED)

FLAP SPAN1 .000	FLAP SPAN2 .600	FLAP SPAN3 1.000	FLAP DEFLEC .000	TAB DEFLEC .000	LAIL DEFLEC .000	RAIL DEFLEC .000	DIMED. MCC/4 89,999	SWEPT MCC/4 97,428	NO.SPAN ELEMENTS 3	NO.CHORD ELEMENTS 2	NO.CHORD DISCONT, 0
			FUS STA X(CG) -60,491	WING STA Y(CG) .000	HL STA Z(CG) .458	AREA S(CG) 6297,748	CHORD C(CG) 78,931	SPAN S(CG) 109,000			

WS	Y	Z	X(LE)	X(C/4)	X(TLE)	TWIST	DIHE(C/4)	SWEPT(C/4)	C(WING)	C(FLAP)	C(TAB)
.000	14,317	.073	-31,552	-24,716	-4,208	-1,000	-.441	85,620	27,344	6,836	3,418
.720	14,317	-.646	-30,171	-23,590	-3,848	-1,000	89,999	97,428	26,323	6,861	3,290
1.439	14,317	-1.366	-28,789	-22,464	-3,487	-1,000	89,999	97,428	25,302	6,885	3,163
2.159	14,317	-2.085	-27,408	-21,338	-3,127	-1,000	89,999	97,428	24,281	6,909	3,039
2.878	14,317	-2.805	-26,026	-20,212	-2,767	-1,000	89,999	97,428	23,260	6,933	2,915
3.598	14,317	-3.524	-24,645	-19,085	-2,406	-1,000	89,999	97,428	22,239	6,957	2,790
4.317	14,317	-4.244	-23,263	-17,959	-2,046	-1,000	89,999	97,428	21,218	6,981	2,666
5.037	14,317	-4.963	-21,882	-16,833	-1,685	-1,000	89,999	97,428	20,197	7,005	2,542
5.756	14,317	-5.683	-20,500	-15,707	-1,325	-1,000	89,999	97,428	19,175	7,029	2,418
6.476	14,317	-6.402	-19,119	-14,580	-.965	-1,000	89,999	97,428	18,154	7,053	2,294
7.195	14,317	-7.122	-17,737	-13,454	-.604	-1,000	89,999	97,428	17,133	7,077	2,170
7.915	14,317	-7.842	-16,356	-12,328	-.244	-1,000	89,999	97,428	16,112	7,101	2,046
8.635	14,317	-8.561	-14,974	-11,202	.117	-1,000	89,999	97,428	15,091	7,125	1,922
9.354	14,317	-9.281	-13,593	-10,075	.477	-1,000	89,999	97,428	14,070	7,149	1,798
10.074	14,317	-10.000	-12,211	-8,949	.837	-1,000	89,999	97,428	13,049	7,173	1,674
10.793	14,317	-10.720	-10,830	-7,823	1.198	-1,000	89,999	97,428	12,028	7,197	1,550
11.513	14,317	-11.439	-9,448	-6,697	1.558	-1,000	89,999	97,428	11,007	7,221	1,426
12.232	14,317	-12.159	-8,067	-5,571	1.919	-1,000	89,999	97,428	9,986	7,245	1,302
12.952	14,317	-12.878	-6,685	-4,444	2.279	-1,000	89,999	97,428	8,965	7,269	1,178
13.671	14,317	-13.598	-5,304	-3,318	2.640	-1,000	89,999	97,428	7,944	7,293	1,054
14.391	14,317	-14.317	-3,922	-2,192	3.000	-1,000	89,999	97,428	6,923	7,317	930

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 9

XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
.0000	1.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
-4.2083	14,3174	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
3.0000	14,3174	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

(EOF PLOT FILE 4) FILE # 4 - LEFT VERTICAL FIN GEOMETRY

(EOF PLOT FILE 5) FILE # 5 - RIGHT VERTICAL FIN GEOMETRY (IMAGE)

NOTATION = 1/(1,1), INDICATES SOLUTION FOR SURFACE # 1 IS OUTPUT  
CONSIDERING SURFACE # 1 ALONE.SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/(1,1)  
\*\*\*\*\*

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
12	.0227	2,386	.000	2,386	.2030	.0019	.1996	.0356	-.0496	.2118	-.0034	.0011	-1.0000
13	.0482	7,159	.368	7,159	.2600	-.0018	.2564	.0448	-.0431	.2413	-.0081	.0315	-.9995
14	.1136	11,931	1.026	11,931	.2622	-.0062	.2593	.0448	-.0515	.2156	-.0089	.0265	-.9996
15	.1591	16,703	1.917	16,704	.3139	-.0071	.3103	.0533	-.0405	.2332	-.0196	.0195	-.9996
16	.2045	21,476	1.846	21,477	.3283	-.0146	.3259	.0549	-.0241	.2188	-.0354	.0175	-.9992
17	.2500	26,248	2.022	26,249	.3339	-.0271	.3335	.0533	-.0180	.1905	-.0398	.0139	-.9991
18	.2955	31,021	2.040	31,022	.3442	-.0341	.3449	.0538	-.0192	.1625	-.0496	.0118	-.9987
19	.3409	35,793	1.770	35,794	.3752	-.0407	.3766	.0581	-.0239	.1398	-.0557	.0009	-.9984
20	.3864	40,566	1.293	40,567	.4301	-.0493	.4321	.0661	-.0281	.1171	-.0562	.0011	-.9984
21	.4318	45,338	.816	45,339	.5193	-.0555	.5228	.0788	-.0349	.0894	-.0594	.0020	-.9982
22	.4773	50,111	.338	50,112	.7439	-.1086	.7515	.1103	-.0721	.0633	-.1066	.0039	-.9978

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE  
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= 10.00 MACHNO= .2000 ALTITUDE=\*\*\*\*\* 10

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 1  
\*\*\*\*\*

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.3048	-.0160	-.0000	.3030	.0372	-.0622	-.0000	-.0000	-.59,77	.97	6196,66	76,78	104,99
1	.0396*	.0163*	.0000*	.0361*	.0230*	-.0064*	-.0000*	.0000*	-.59,77*	.97*	6196,66*	76,78*	104,99*

\*\*\* AIRLOAD SUMS \*\*\*

AC	CG	CC	CD	CM	CR	CMY	EXA	EZA	ES	EMGC	EB	
.3048	-.0160	-.0000	.3030	.0372	-.0622	-.0000	-.0000	-.59,77	.97	6196,66	76,78	104,99
.2999	-.0157	-.0000	.2981	.0366	-.0624	-.0000	-.0000	-.60,49	.96	6297,75	78,53	105,00
.0396*	.0163*	.0000*	.0361*	.0230*	-.0064*	.0000*	.0000*	-.59,77*	.97*	6196,66*	76,78*	104,99*
.0389*	.0161*	.0000*	.0356*	.0226*	-.0066*	.0000*	.0000*	-.60,49*	.96*	6297,75*	78,53*	105,00*

\* DETERMINANT= -.1875+13 \* SCALE= .1731-01 \*

LIFT COEFFICIENT FOR WING ALONE IS  $C_L = 0.2881$  WITH L.E. SUCTION (BLUNT L.E.)  
= 0.8337 NO L.E. SUCTION (SHARP L.E.)SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/(1,2)  
\*\*\*\*\*NOTATION = 1/(1,2), INDICATES SOLUTION FOR SURFACE # 1 IS OUTPUT  
CONSIDERING SURFACES # 1 AND # 2 SIMULTANEOUSLY

## 6.4 EXAMPLE PROBLEM # 3, NORTH AMERICAN XB-70 AIRPLANE (CONTINUED)

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
12	.0227	2.386	.000	2.386	.1354	.0041	.1327	.0242	-.0469	.1408	-.0027	.0009	-1.0000
13	.0682	7.159	.368	7.159	.1769	.0004	.1742	.0308	-.0438	.1640	-.0074	.0313	-.9995
14	.1136	11.931	1.026	11.931	.1944	-.0033	.1920	.0332	-.0495	.1596	-.0091	.0266	-.9996
15	.1591	16.723	1.517	16.704	.2452	-.0049	.2423	.0417	-.0399	.1821	-.0197	.0197	-.9996
16	.2045	21.476	1.846	21.477	.2743	-.0110	.2722	.0456	-.0259	.1827	-.0353	.0174	-.9992
17	.2500	26.248	2.022	26.249	.2932	-.0230	.2928	.0469	-.0196	.1672	-.0397	.0138	-.9991
18	.2955	31.021	2.040	31.022	.3134	-.0304	.3139	.0491	-.0199	.1479	-.0496	.0318	-.9987

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE  
 VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= 10.00 MACHNO= .2000 ALTITUDE\*\*\*\*\* 11

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
19	.3409	35.793	1.770	35.794	.3497	-.0374	.3509	.0542	-.0240	.1302	-.0556	.0009	-.9985
20	.3864	40.566	1.293	40.567	.4081	-.0464	.4100	.0628	-.0278	.1111	-.0561	.0010	-.9984
21	.4318	45.338	.816	45.339	.4997	-.0627	.5030	.0759	-.0345	.0860	-.0593	.0019	-.9982
22	.4773	50.111	.338	50.112	.7241	-.1053	.7313	.1074	-.0711	.0519	-.0664	.0039	-.9978

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 2/( 1, 2)  
\*\*\*\*\*

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
27	.0833	2.386	-6.196	107.733	.9782	.0897	.9478	.1854	-.1495	.6179	.1061	-.0158	-.9942
28	.2500	7.159	-6.112	112.505	1.1336	.0804	1.1024	.2108	-.1194	.5554	.1311	-.0246	-.9911
29	.4167	11.931	-6.063	117.278	1.1479	.0670	1.1189	.2110	-.1132	.3978	.1249	-.0314	-.9917

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 2  
\*\*\*\*\*

E	ECN	ECX	ECY	ECL	ECO	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.2479	-.0132	.0000	.2464	.0300	-.0667	-.0000	-.0000	-.59.77	.97	6196.66	76.78	104.99
1	.0338	.0147	.0000	.0308	.0196	-.0070	-.0000	-.0000	-.59.77	.97	6196.66	76.78	104.99
2	.1070	.0381	.0000	1.0396	.2658	-.1462	-.0000	.0000	-147.38	-6.26	413.07	15.36	28.63
2	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	-147.38	-6.26	413.07	15.36	28.63

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE  
 VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= 10.00 MACHNO= .2000 ALTITUDE\*\*\*\*\* 12

## \*\*\* AIRLOAD SUMS \*\*\*

AC	.3192	-.0678	.0000	.3157	.0478	.0133	-.0000	-.0000	-.59.77	.97	6196.66	76.78	104.99
CG	.3141	-.0677	.0000	.3106	.0470	.0099	-.0000	-.0000	-.60.49	.46	6297.75	78.53	105.00
AC	.0338	.0147	.0000	.0308	.0196	-.0070	-.0000	.0000	-.59.77	.97	6196.66	76.78	104.99
CG	.0332	.0137	.0000	.0303	.0193	-.0072	-.0000	.0000	-.60.49	.46	6297.75	78.53	105.00

\* DETERMINANT= -.1070+22 \* SCALE= .1505-01 \*

LIFT COEFFICIENT FOR WING +CANARD CONTROL SURFACE IS  
 $C_L = 0.3108$  (WITH L.E. SUCTION)SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/( 1, 4)  
\*\*\*\*\*NOTATION = 1/(1,4), INDICATES SOLUTION FOR SURFACE # 1 IS OUTPUT  
 CONSIDERING SURFACES #1, #2, #3, and #4 SIMULTANEOUSLY

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
12	.0227	2.386	.000	2.386	.1155	.0003	.1137	.0201	-.0356	.1207	-.0129	.0043	-.9999
13	.0682	7.159	.368	7.159	.1494	-.0023	.1476	.0256	-.0329	.1389	-.0303	.0388	-.9988
14	.1136	11.931	1.026	11.931	.1832	-.0006	.1805	.0317	-.0271	.1501	-.0833	.0469	-.9994
15	.1591	16.723	1.517	16.704	.2314	-.0024	.2283	.0398	-.0596	.1715	-.0191	-.0209	-.9996
16	.2045	21.476	1.846	21.477	.2616	-.0126	.2598	.0432	-.0402	.1744	-.0264	.0150	-.9995
17	.2500	26.248	2.022	26.249	.2986	-.0148	.2966	.0493	-.0296	.1694	-.0426	.0146	-.9990
18	.2955	31.021	2.040	31.022	.3212	-.0306	.3217	.0505	-.0213	.1516	-.0440	.0108	-.9989
19	.3409	35.793	1.770	35.794	.3511	-.0372	.3523	.0545	-.0240	.1307	-.0555	.0009	-.9985
20	.3864	40.566	1.293	40.567	.4076	-.0455	.4093	.0629	-.0280	.1110	-.0555	.0009	-.9985
21	.4318	45.338	.816	45.339	.4988	-.0615	.5019	.0759	-.0346	.0858	-.0593	.0019	-.9982
22	.4773	50.111	.338	50.112	.7226	-.1047	.7298	.1073	-.0710	.0518	-.0663	.0039	-.9978

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE  
 VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= 10.00 MACHNO= .2000 ALTITUDE\*\*\*\*\* 13

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 2/( 1, 4)  
\*\*\*\*\*

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
27	.0833	2.386	-6.196	107.733	1.0252	.1017	.9920	.1957	-.1433	.6488	.1166	-.0164	-.9930
28	.2500	7.159	-6.112	112.505	1.2074	.0904	1.1734	.2254	-.1308	.5911	.1312	-.0246	-.9911
29	.4167	11.931	-6.063	117.278	1.2471	.0793	1.2144	.2303	-.1267	.4318	.1267	-.0315	-.9914

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 3/( 1, 4)  
\*\*\*\*\*

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
32	.2500	2.386	.000	137.607	.0288	.0079	.0270	.0064	-.0150	.1626	.0693	-.2129	-.9746

## 6.4 EXAMPLE PROBLEM # 3, NORTH AMERICAN XB-70 AIRPLANE (CONTINUED)

SECTION AIRLOAD COEFFICIENTS-SURFACE NOS. = 4( 1, 4 )

SECTION LIFT COEFFICIENTS FOR SURFACE # 4 ARE OUT OF RANGE  
SEE NOTE # 1. †

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
38	.9949	14.317	-2.074	151.937	.....	.....	.....	943.53992580	0793	.....	.0768	.9943	.0766
39	.9949	14.317	-6.943	156.7346153	4659	.....	6682.7775	445.7413	796.36737956	2665	.0032	-1.0000	.0033
40	.9949	14.317	-11.811	161.531	75.2273	-93.2598	90.2788	-3.1313	-53.5006	64.7788	-.0162	.9997	-.0165

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS. = 1 - 4

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
---	-----	-----	-----	-----	-----	------	------	------	-----	-----	----	------	----

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 3 = XB-70 AIRPLANE SUBSONIC AEROD PAGE 14  
 VALUE 22 4 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= 10.00 MACHNO= .2000 ALTITUDE=.....

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS. = 1 - 4

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.2368	-.0129	.0000	.2355	.0285	-.0651	-.0000	-.0000	-59.77	.97	6196.66	76.78	104.99
1	.0314	.0129	-.0000	.0286	.0182	-.0070	-.0000	.0000	-59.77	.97	6196.66	76.78	104.99
2	1.1382	.0927	.0000	1.1048	.2689	-.1511	-.0000	.0000	-147.38	-6.26	413.07	16.36	28.63
2	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	-147.38	-6.26	413.07	16.36	28.63
3	.0288	.0079	.0000	.0270	.0128	-.0151	.0000	.0000	-158.98	.00	548.83	47.40	9.54
3	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	-158.98	.00	548.83	47.40	9.54
4	.0710	-.0372	.0000	.0764	-.0243	-.0324	-.0000	.0000	-15.69	-5.44	493.13	19.16	14.39
4	.....	.0372	-.0000	.....	.....	.....	.0000	.0000	-15.69	-5.44	493.13	19.16	14.39

\*\*\* AIRLOAD SUMS \*\*\*

AC	.3209	-.0089	.0000	.3176	.0469	.0195	-.0000	-.0000	-59.77	.97	6196.66	76.78	104.99
CG	.3157	-.0088	.0000	.3125	.0462	.0159	-.0000	-.0000	-60.49	.94	6297.75	78.53	105.00
AC	272.7074	.0159	-.0000	268.6618	47.3708	.....	.0000	.0000	-59.77	.97	6196.66	76.78	104.99
CG	268.3302	.0156	-.0000	264.2510	46.6104	.....	.0000	.0000	-60.49	.94	6297.75	78.53	105.00

\* DETERMINANT = .5389+32 \* SCALE = .1409-01 \*

VORTEX-LIFT INCREMENTS FOR SURFACE # 4 ARE OUT OF RANGE

SEE NOTE # 2. †

\*\*\*\* JOB TIME= 246 / ELAPSED TIME= 246 / NO.PLOT FILES= 5 / NSURF EXEC. VERSION 6-18-72 \*\*\*\*

XQT TRWFLY PRINTED OUTPUT OMITTED  
 SEE INPUT DATA LISTINGS

- † NOTES: [1] THE SECTION COEFFICIENTS CALCULATED FOR SURFACE # 4, THE VERTICAL FINS, ARE OUT OF RANGE OF THE "F" FORMAT SPECIFICATION USED FOR THE PRINTED OUTPUT. THIS ANOMALY ARISES BECAUSE OF THE MANNER IN WHICH THESE COEFFICIENTS ARE CALCULATED, I.E., THE AIRLOADS OBTAINED IN THE VORTEX-LATTICE SOLUTION ARE NORMALIZED BY (DIVIDED BY) THE PROJECTED AREA OF THE SURFACE ON A HORIZONTAL PLANE WHICH IS OF ZERO ORDER FOR A VERTICAL SURFACE. THIS PROGRAMMING ERROR DOES NOT IN ANY WAY AFFECT THE ACCURACY OF THE VORTEX-LATTICE SOLUTION OR THE SPATIALLY-INTEGRATED AIRLOAD COEFFICIENTS WHICH ARE NORMALIZED BY A DIFFERENT AREA.
- [2] THE VORTEX-LIFT INCREMENTS CALCULATED FOR SURFACE # 4, THE VERTICAL FINS, ARE OUT OF RANGE AND IN ERROR FOR THE SAME REASONS OUTLINED IN NOTE # 1.
- [3] TO DEMONSTRATE THE VERACITY OF THE SOLUTIONS CALCULATED WITH AND WITHOUT VERTICAL FINS A COMPARISON OF THE NET-AIRLOAD COEFFICIENTS ABOUT THE C.G. OBTAINED FOR THE VORTEX-LATTICE SOLUTIONS (WITH I.E. SUCTION) IS GIVEN BELOW

CODE	DESCRIPTION	$C_L$	$C_{D_i}$	$C_{M_{CG}}$
(1,1)	WING ALONE	0.2981	0.0366	-0.0624
(1,2)	WING + CANARD	0.3106	0.0470	+0.0099
(1,4)	WING + CANARD + FUSELAGE + VERT. FINS	0.3125	0.0462	+0.0159



6.5 EXAMPLE PROBLEM # 4, THICK-WING ANALYSIS (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 0 1 1 2 ALPHA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 2

LIFTING SURFACE NO= 1 SURFACE # 1 = LOWER SURFACE  
\*\*\*\*\*

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
20.000	10.000	10.000	.0000	.0000	200.00	2.0000	10.000	10.000	5.000	.000	.734
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.600	1.000	.000	.000	.000	.000	.000	.000	10	5	0
FUS STA X(CG)	WING STA Y(CG)	HL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)						
.000	.000	.000	200.000	10.000	20.000						
WS	Y	Z	X(LE)	X(C/4)	X(TIE)	TWIST	DIHED(C/4)	SWEEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-10.000	-10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-9.000	-9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-8.000	-8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-7.000	-7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-6.000	-6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-5.000	-5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-4.000	-4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-3.000	-3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-2.000	-2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-1.000	-1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
.000	.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
1.000	1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
2.000	2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
3.000	3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
4.000	4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
5.000	5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
6.000	6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
7.000	7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
8.000	8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
9.000	9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
10.000	10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 0 1 1 2 ALPHA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 3

		KA(1)/C	KA(2)/C	KA(3)/C	KA(4)/C	KA(5)/C	KA(6)/C	KA(7)/C	KA(8)/C	KA(9)/C	KA(10)/C
		.0000	.0500	.1000	.1500	.2000	.3000	.4000	.6000	.8000	1.0000
X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
.0000	.0000	.0000	.0444	.0585	.0668	.0717	.0750	.0725	.0570	.0328	.0000
.0000	10.0000	.0000	.0444	.0585	.0668	.0717	.0750	.0725	.0570	.0328	.0000

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 0 1 1 2 ALPHA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 6

LIFTING SURFACE NO= 2 SURFACE # 2 = UPPER SURFACE  
\*\*\*\*\*

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
20.000	10.000	10.000	.0000	.0000	200.00	2.0000	10.000	10.000	5.000	.000	-.734
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.600	1.000	.000	.000	.000	.000	.000	.000	10	5	0
FUS STA X(CG)	WING STA Y(CG)	HL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)						
.000	.000	.000	200.000	10.000	20.000						
WS	Y	Z	X(LE)	X(C/4)	X(TIE)	TWIST	DIHED(C/4)	SWEEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-10.000	-10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-9.000	-9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-8.000	-8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-7.000	-7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-6.000	-6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-5.000	-5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-4.000	-4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-3.000	-3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-2.000	-2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-1.000	-1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
.000	.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
1.000	1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
2.000	2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
3.000	3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
4.000	4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
5.000	5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
6.000	6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
7.000	7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
8.000	8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
9.000	9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
10.000	10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250

## 6.5 EXAMPLE PROBLEM # 4, THICK-WING ANALYSIS (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 1 1 2 ALFA=.00 MACHNO=.0000 ALTITUDE=\*\*\*\*\* 7

		XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
		.0000	.0500	.1000	.1500	.2000	.3000	.4000	.6000	.8000	1.0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
.0000	.0000	.0000	-.0444	-.0585	-.0668	-.0717	-.0750	-.0725	-.0570	-.0328	.0000
.0000	10.0000	.0000	-.0444	-.0585	-.0668	-.0717	-.0750	-.0725	-.0570	-.0328	.0000

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 1 1 2 ALFA=.00 MACHNO=.0000 ALTITUDE=\*\*\*\*\* 10

LIFTING SURFACE NO= 3 SURFACE # 3 = THIN WING (FLAT PLATE)  
\*\*\*\*\*

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
20.000	10.000	10.000	.0000	.0000	200.00	2.0000	10.000	10.000	5.000	.000	.000

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIMED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.600	1.000	.000	.000	.000	.000	.000	.000	10	5	0

FUS STA X(CG)	WING STA Y(CG)	HL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
.000	.000	.000	200.000	10.000	20.000

MS	Y	Z	X(LE)	X(C/4)	X(T)	TWIST	DIME(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-10.000	-10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-9.000	-9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-8.000	-8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-7.000	-7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-6.000	-6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-5.000	-5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-4.000	-4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-3.000	-3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-2.000	-2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-1.000	-1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
.000	.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
1.000	1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
2.000	2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
3.000	3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
4.000	4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
5.000	5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
6.000	6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
7.000	7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
8.000	8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
9.000	9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
10.000	10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 1 1 2 ALFA=.00 MACHNO=.0000 ALTITUDE=\*\*\*\*\* 11

		XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
		.0000	1.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	10.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 1 1 2 ALFA=.00 MACHNO=.0000 ALTITUDE=\*\*\*\*\* 13

J	K	XV	YV	ZV	LXV	LYV	LZV	XN	YN	ZN	LXN	LYN	LZN
25	3	2.000+00	-6.000+00	0.000	0.000	1.000+00	0.000	3.000+00	-5.000+00	0.000	0.000	0.000	0.000
26	3	2.000+00	-4.000+00	0.000	0.000	1.000+00	0.000	3.000+00	-3.000+00	0.000	0.000	0.000	1.000+00
27	3	2.000+00	-2.000+00	0.000	0.000	1.000+00	0.000	3.000+00	-1.000+00	0.000	0.000	0.000	1.000+00
28	3	2.000+00	0.000+00	0.000	0.000	1.000+00	0.000	3.000+00	0.000+00	0.000	0.000	0.000	1.000+00
29	3	2.000+00	2.000+00	0.000	0.000	1.000+00	0.000	3.000+00	1.000+00	0.000	0.000	0.000	1.000+00
30	3	2.000+00	4.000+00	0.000	0.000	1.000+00	0.000	3.000+00	3.000+00	0.000	0.000	0.000	1.000+00
31	3	2.000+00	6.000+00	0.000	0.000	1.000+00	0.000	3.000+00	5.000+00	0.000	0.000	0.000	1.000+00
32	5	6.000+00	8.000+00	0.000	0.000	1.000+00	0.000	7.000+00	9.000+00	0.000	0.000	0.000	1.000+00

IEOF PLDT FILE 3)

LIFT DISTRIBUTION DETAIL-SURFACE NO.= 1(1, 2)  
\*\*\*\*\*

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
1	1	-2.000	-9.000	.444	4.0000	2.7285	.17193	.00000	1.01942	.03461	-1.11482	.00172	-.2729+01
1	2	-1.000	-9.000	.734	4.0000	-.1951	.04557	.00000	.84616	-.13865	-.95122	.12807	-.1951+00
1	3	2.000	-9.000	.667	4.0000	-1.1031	.03735	.00000	-.81783	-.16698	-.76524	-.13630	.1103+01

## 6.5 EXAMPLE PROBLEM # 4, THICK-WING ANALYSIS (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 1 1 2 ALFA= 10.00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 17

## SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/1 1, 2)

LOWER SURFACE

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	IXL	IYL	IZL
6	.0500	1.000	-.668	1.000	.9268	.1357	.8892	.1845	-.7111	.4446	.0574	.0000	-.9984
7	.1500	3.000	-.668	3.000	.9449	.1384	.9085	.1885	-.6830	.4543	.0616	.0000	-.9981
8	.2500	5.000	-.668	5.000	.9756	.1326	.9377	.1924	-.5930	.4689	.0690	.0000	-.9976
9	.3500	7.000	-.668	7.000	.9878	.1213	.9344	.2100	-.4762	.4672	.1006	.0000	-.9949
10	.4500	9.000	-.668	9.000	.6172	-.0015	.6081	.1069	-.0657	.3041	.1225	.0000	-.9925

## SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 2/1 1, 2)

UPPER SURFACE

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	IXL	IYL	IZL
17	.0500	1.000	-.668	21.000	-.1651	.0921	-.1786	-.0127	.6512	-.0893	.0459	-.0000	.9989
18	.1500	3.000	-.668	23.000	-.2141	.1103	-.2300	-.0180	.6162	-.1150	.0479	.0000	.9989
19	.2500	5.000	-.668	25.000	-.3032	.1480	-.3243	-.0270	.5209	-.1622	.0670	.0000	.9978
20	.3500	7.000	-.668	27.000	-.4921	.0445	-.4923	-.0777	.3681	-.2462	.0680	.0000	.9977
21	.4500	9.000	-.668	29.000	-.2507	.2142	-.2841	-.0063	.1903	-.1421	.2801	.0000	.9600

## INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 2

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.8909	.1253	.0000	.8556	.2781	-.5014	-.0000	.0000	.00	.73	200.00	10.00	20.00
1	.0003*	.0003*	.0000*	.0002*	.0003*	.0001*	.0000*	.0000*	.00*	.73*	200.00*	10.00*	20.00*
2	-.2850	.1218	.0000	-.3019	.0705	.4645	-.0000	.0000	.00	-.73	200.00	10.00	20.00
2	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.00*	-.73*	200.00*	10.00*	20.00*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 1 1 2 ALFA= 10.00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 18

## \*\*\* AIRLOAD SUMS \*\*\*

VORTEX-LATTICE SOLUTIONS FOR THICK WING (1,2)  
 $C_L = 0.5537$ ,  $C_D = 0.3485$ ,  $C_{M(C/4)} = -0.0373$

AC	CG	AC	CG
.6058	.2471	.0000	.5537
.6058	.2471	.0000	.5537
.0003*	.0003*	.0000*	.0002*
.0003*	.0003*	.0000*	.0003*

\* DETERMINANT= .4360+23 \* SCALE= .6619-01 \*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC PAGE  
VALUE 10 10 10 0 0 5 5 5 0 0 0 0 0 0 0 0 0 1 1 2 ALFA= 10.00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 19

## SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 3/1 3, 3)

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	IXL	IYL	IZL
28	.0500	1.000	.000	41.000	.5577	-.0519	.5583	.0878	.0031	.2791	-.0090	.0000	-1.0000
29	.1500	3.000	.000	43.000	.5416	-.0491	.5419	.0855	.0029	.2710	-.0086	.0000	-1.0000
30	.2500	5.000	.000	45.000	.5067	-.0426	.5064	.0806	.0014	.2532	-.0080	.0000	-1.0000
31	.3500	7.000	.000	47.000	.4437	-.0301	.4422	.0718	-.0045	.2211	-.0071	.0000	-1.0000
32	.4500	9.000	.000	49.000	.3261	-.0151	.3238	.0540	-.0191	.1619	-.0152	.0000	-.9999

## INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 3 - 3

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.00	.73	200.00	10.00	20.00
1	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.00*	.73*	200.00*	10.00*	20.00*
2	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.00	-.73	200.00	10.00	20.00
2	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.00*	-.73*	200.00*	10.00*	20.00*
3	.4752	-.0378	.0000	.4745	.0453	-.0032	.0000	.0000	.00	.00	200.00	10.00	20.00
3	.0378*	.0378*	.0000*	.0306*	.0438*	.0094*	.0000*	.0000*	.00*	.00*	200.00*	10.00*	20.00*

## \*\*\* AIRLOAD SUMS \*\*\*

AC	CG	AC	CG
.4752	-.0378	.0000	.4745
.4752	-.0378	.0000	.4745
.0378*	.0378*	.0000*	.0306*
.0378*	.0378*	.0000*	.0438*

\* DETERMINANT= .3470+12 \* SCALE= .9800-01 \*

VORTEX-LATTICE SOLUTIONS FOR THIN WING (PLAT PLATE)  
 $C_L = 0.4745$ ,  $C_D = 0.0453$ ,  $C_{M(C/4)} = -0.0032$

\*\*\*\* JOB TIME= 74 / ELAPSED TIME= 74 / NO.PLOT FILES= 3 / NSURF EXEC. VERSION 6-1B-72 \*\*\*\*

\*\*\*  
XQT TRIMPL OUTPUT OMITTED  
SEE INPUT-DATA LISTINGS





## 6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO, 5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)\* 0 PAGE  
 VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 0 1 0 0 ALFA= .00 MACHNO= .0000 ALTITUDE\*\*\*\*\* 2

## LIFTING SURFACE NO= 1

\*\*\*\*\*

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	VBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
20.000	10.000	10.000	.0000	.0000	200.00	2.0000	10.000	10.000	5.000	.000	.000
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	LAIL DEFLEC	RAIL DEFLEC	DIMED, MGC/4	SWEPT MGC/4	NO, SPAN ELEMENTS	NO, CHORD ELEMENTS	NO, CHORD DISCONT,
.00	.600	1.000	10.000	.000	.000	.000	.000	.000	3	2	1
FUS STA X(CG)	WING STA Y(CG)	HL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)						
.000	.000	.000	1000.000	100.000	100.000						

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIME(C/4)	SWEPT(C/4)	C(WING)	C(FLAP)	C(TAB)
-10.000	-10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-9.000	-9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-8.000	-8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-7.000	-7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-6.000	-6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-5.000	-5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-4.000	-4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-3.000	-3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-2.000	-2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-1.000	-1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
.000	.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
1.000	1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
2.000	2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
3.000	3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
4.000	4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
5.000	5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
6.000	6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
7.000	7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
8.000	8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
9.000	9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
10.000	10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO, 5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)\* 0 PAGE  
 VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 0 1 0 0 ALFA= .00 MACHNO= .0000 ALTITUDE\*\*\*\*\* 3

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	10.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

## SECTION AIRLOAD COEFFICIENTS-SURFACE NO, 1 ( 1, 1)

\*\*\*\*\*

J	Y.	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
2	-.0000	-.0000	.0000	.0000	.4870	.0062	.4846	.0430	-.1245	.2423	.0103	.0000	-.9999
3	.3333	.6667	.0000	.6667	.3010	-.0247	.3020	.0241	.0141	.1510	.0038	-.0163	-.9999

## INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS, 1 - 1

\*\*\*\*\*

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
1	.3164	.0164	.0000	.0149	.0178	.0041	-.0000	.0000	.00	.00	200.00	10.00	20.00

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO, 5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)\* 0 PAGE  
 VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 0 1 0 0 ALFA= .00 MACHNO= .0000 ALTITUDE\*\*\*\*\* 4

## \*\*\* AIRLOAD SUMS \*\*\*

AC	CG	AC	CG	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00				
.3726	-.0029	.0000	.0726	.0035	-.0006	-.0000	-.0000	.00	.00	1000.00	100.00	100.00				
.3164	.0164	.0000	.0149	.0178	.0041	-.0000	.0000	.00	.00	200.00	10.00	20.00				
.0033	.0033	.0000	.0030	.0036	.0001	-.0000	.0000	.00	.00	1000.00	100.00	100.00				

\* DETERMINANT= .1073+02 \* SCALE= .7042-01 \*

\*\*\*\* JOB TIME= 1 / ELAPSED TIME= 1 / NO, PLOT FILES= 0 / NSURF EXEC, VERSION 6-18-72 \*\*\*\*

\*\*\*\*\*

## 6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO. 5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 1 PAGE  
VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 0 1 0 1 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 7

XA(1)/C XA(2)/C XA(3)/C XA(4)/C XA(5)/C XA(6)/C XA(7)/C XA(8)/C XA(9)/C XA(10)/C  
.0000 1.0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000

X Y ZA(1)/C ZA(2)/C ZA(3)/C ZA(4)/C ZA(5)/C ZA(6)/C ZA(7)/C ZA(8)/C ZA(9)/C ZA(10)/C  
.0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000  
.0000 10.0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000

J K V Z WL EW DWL DC DS  
1 1 -6.667+00 0.000 6.667+00 6.667+00 6.667+00 7.500+00 5.000+01  
2 1 -5.960+00 0.000 0.000 0.000 6.667+00 7.500+00 5.000+01  
3 1 6.667+00 0.000 6.667+00 6.667+00 6.667+00 7.500+00 5.000+01  
1 2 -6.667+00 0.000 6.667+00 6.667+00 6.667+00 2.500+00 1.667+01  
2 2 -5.960+00 0.000 0.000 0.000 6.667+00 2.500+00 1.667+01  
3 2 6.667+00 0.000 6.667+00 6.667+00 6.667+00 2.500+00 1.667+01

J K XV YV ZV 1XV 1YV 1ZV XN YN ZN 1XN 1YN 1ZN  
1 1 -6.250+01 -1.000+01 0.000 0.000 1.000+00 0.000 3.125+00 -6.667+00 0.000 0.000 0.000 1.000+00  
2 1 -6.250+01 -3.333+00 0.000 0.000 1.000+00 0.000 3.125+00 -5.960+00 0.000 0.000 0.000 1.000+00  
3 1 -6.250+01 3.333+00 0.000 0.000 1.000+00 0.000 3.125+00 6.667+00 0.000 0.000 0.000 1.000+00  
1 2 5.625+00 -1.000+01 0.000 0.000 1.000+00 0.000 6.875+00 -6.667+00 0.000 0.000 0.000 1.000+00  
2 2 5.625+00 -3.333+00 0.000 0.000 1.000+00 0.000 6.875+00 -5.960+00 0.000 0.000 0.000 1.000+00  
3 2 5.625+00 3.333+00 0.000 0.000 1.000+00 0.000 6.875+00 6.667+00 0.000 0.000 0.000 1.000+00

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/( 1, 1)  
\*\*\*\*\*

J Y\* Y Z W SCN SCX SCL SCD SMP C/4 SCLC/B 1XL 1YL 1ZL  
2 .0000 -.0000 .0000 .0000 .4870 .0062 .4846 .0430 -.1245 .2423 .0103 .0000 -.9999  
3 .3333 6.667 .0000 6.667 .3010 -.0247 .3020 .0241 .0141 .1510 .0038 -.0163 -.9999

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO. 5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 1 PAGE  
VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 0 1 0 1 ALFA= 5.00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 8

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 1  
\*\*\*\*\*

E ECN ECK ECV ECL ECD ECMP ECMR ECMY EXA EZA ES EMGC EB  
1 .3630 -.0144 .0000 .3629 .0173 -.0321 -.0000 -.0000 .00 .00 200.00 10.00 20.00  
1 .0164 .0164 .0000 .0149 .0178 .0041 -.0000 -.0000 .00 .00 200.00 10.00 20.00  
\*\*\* AIRLOAD SUMS \*\*\*  
AC .3630 -.0144 .0000 .3629 .0173 -.0321 -.0000 -.0000 .00 .00 200.00 10.00 20.00  
CG .0726 -.0022 .0000 .0726 .0035 -.0006 -.0000 -.0000 .00 .00 100.00 10.00 10.00  
AC .0164 .0164 .0000 .0149 .0178 .0041 -.0000 -.0000 .00 .00 200.00 10.00 20.00  
CG .0033 .0033 .0000 .0030 .0036 .0001 -.0000 -.0000 .00 .00 100.00 10.00 10.00

\* DETERMINANT= .1073+02 \* SCALE= .7042-01 \*

\*\*\*\* JOB TIME= 1 / ELAPSED TIME= 2 / NO.PLOT FILES= 0 / NSURF EXEC, VERSION 6-16-72 \*\*\*\*

\*\*\*\*\*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO. 5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 2 PAGE  
VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 0 1 0 2 ALFA= .00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 11

XA(1)/C XA(2)/C XA(3)/C XA(4)/C XA(5)/C XA(6)/C XA(7)/C XA(8)/C XA(9)/C XA(10)/C  
.0000 1.0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000

X Y ZA(1)/C ZA(2)/C ZA(3)/C ZA(4)/C ZA(5)/C ZA(6)/C ZA(7)/C ZA(8)/C ZA(9)/C ZA(10)/C  
.0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000  
.0000 10.0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000 .0000

J K V Z WL EW DWL DC DS  
1 1 -6.667+00 0.000 6.667+00 6.667+00 6.667+00 7.500+00 5.000+01  
2 1 -5.960+00 0.000 0.000 0.000 6.667+00 7.500+00 5.000+01  
3 1 6.667+00 0.000 6.667+00 6.667+00 6.667+00 7.500+00 5.000+01

ORIGINAL PAGE IS  
OF POOR QUALITY

## 6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

```

1 2 -6.667+00 0.000 6.667+00 6.667+00 6.667+00 2.500+00 1.667+01
2 2 -5.960-08 0.000 0.000 0.000 6.667+00 2.500+00 1.667+01
3 2 6.667+00 0.000 6.667+00 6.667+00 6.667+00 2.500+00 1.667+01

```

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
1	1	-6.250-01	-1.000+01	0.000	0.000	1.000+00	0.000	3.125+00	-6.667+00	0.000	0.000	0.000	1.000+00
2	1	-6.250-01	-3.333+00	0.000	0.000	1.000+00	0.000	3.125+00	-5.960-08	0.000	0.000	0.000	1.000+00
3	1	-6.250-01	3.333+00	0.000	0.000	1.000+00	0.000	3.125+00	6.667+00	0.000	0.000	0.000	1.000+00
1	2	5.625+00	-1.000+01	0.000	0.000	1.000+00	0.000	6.875+00	-6.667+00	0.000	0.000	0.000	1.000+00
2	2	5.625+00	-3.333+00	0.000	0.000	1.000+00	0.000	6.875+00	-5.960-08	0.000	0.000	0.000	1.000+00
3	2	5.625+00	3.333+00	0.000	0.000	1.000+00	0.000	6.875+00	6.667+00	0.000	0.000	0.000	1.000+00

## LIFT DISTRIBUTION DETAIL-SURFACE NO.= 1/( 1, 1)

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J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
1	1	-.625	-6.667	.000	50.0000	.3925	.08384	.00000	.99873	.00054	.00568	.00332	-.1472+01
1	2	5.620	-6.667	.054	16.6667	.0302	-.00380	-.01627	.99893	.00287	-.00472	.09088	-.1780+01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 2 PAGE 12

2	1	-.625	-.000	.000	50.0000	.3178	-.01821	.00000	1.00160	.00541	.00000	.10236	-.1192+01
2	2	5.616	-.000	.109	16.6667	.9942	-.01031	.00000	.99872	.00253	.00000	.09747	-.1243+01
3	1	-.625	6.667	.000	50.0000	.3925	.08384	.00000	.99873	.00054	-.00568	.00332	-.1472+01
3	2	5.620	6.667	.054	16.6667	.0302	-.00380	-.01627	.99893	.00287	.00472	.09088	-.1780+01

## SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/( 1, 1)

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J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
2	-.0000	-.000	.000	.000	.4870	.0062	.4846	.0430	-.1245	.2423	.0103	.0000	-.9999
3	.3333	6.667	.000	6.667	.3010	-.0247	.3020	.0241	.0141	.1310	.0038	-.0163	-.9999

## INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 1

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E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
1	.0164	.0164	.0000	.0149	.0178	.0041	-.0000	.0000	.00	.00	200.00	10.00	20.00
*** AIRLOAD SUMS ***													
AC	.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
CG	.0726	-.0029	.0000	.0726	.0035	-.0006	-.0000	-.0000	.00	.00	100.00	10.00	100.00
AC	.0164	.0164	.0000	.0149	.0178	.0041	-.0000	.0000	.00	.00	200.00	10.00	20.00
CG	.0033	.0033	.0000	.0030	.0036	.0003	-.0000	.0000	.00	.00	1000.00	100.00	100.00

\* DETERMINANT= .1073+02 \* SCALE= .7042-01 \*

\*\*\*\* JOB TIME= 1 / ELAPSED TIME= 3 / NO.PLOT FILES= 0 / NSURF EXEC, VERSION 6-18-72 \*\*\*\*

\*\*\*\*\*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 5 PAGE 15

	XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C	
	.0000	1.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	
X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
		.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
		.0000	10.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

J	K	Y	Z	WL	EW	DWL	OC	US
1	1	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.500+00	5.000+01
2	1	-5.960-08	0.000	0.000	0.000	6.667+00	7.500+00	5.000+01
3	1	6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.500+00	5.000+01
1	2	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.500+00	1.667+01
2	2	-5.960-08	0.000	0.000	0.000	6.667+00	2.500+00	1.667+01
3	2	6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.500+00	1.667+01

## 6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
1	1	-6.250-01	-1.000+01	0.000	0.000	1.000+00	0.000	3.125+00	-6.667+00	0.000	0.000	0.000	1.000+00
2	1	-6.250-01	-3.333+00	0.000	0.000	1.000+00	0.000	3.125+00	-5.960-08	0.000	0.000	0.000	1.000+00
3	1	-6.250-01	3.333+00	0.000	0.000	1.000+00	0.000	3.125+00	6.667+00	0.000	0.000	0.000	1.000+00
1	2	5.625+00	-1.000+01	0.000	0.000	1.000+00	0.000	6.875+00	-6.667+00	0.000	0.000	0.000	1.000+00
2	2	5.625+00	-3.333+00	0.000	0.000	1.000+00	0.000	6.875+00	-5.960-08	0.000	0.000	0.000	1.000+00
3	2	5.625+00	3.333+00	0.000	0.000	1.000+00	0.000	6.875+00	6.667+00	0.000	0.000	0.000	1.000+00

## VORTEX LATTICE MATRIX DETAIL-SURFACE NO.= 1/( 1, 1)

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J	K	NP	NG	VFS(MAT)	VIN(MAT)	P(X)	P(Y)	P(Z)	B(X)	B(Y)	B(Z)	D(X)	D(Y)	D(Z)
2	1	1	1	-.8716-01	.1113+00	.3125+01	-.5960-07	.0000	-.6250+00	-.3333+01	.0000	-.6250+00	.3333+01	.0000
2	1	1	2	-.8716-01	-.5010-01	.3125+01	-.5960-07	.0000	-.6250+00	.3333+01	.0000	-.6250+00	.1000+02	.0000
2	1	1	3	-.8716-01	.2476-01	.3125+01	-.5960-07	.0000	.5616+01	-.3333+01	.1085+00	.5616+01	.3333+01	.1085+00
2	1	1	4	-.8716-01	-.6688-01	.3125+01	-.5960-07	.0000	.5616+01	.3333+01	.1085+00	.5625+01	.1000+02	.0000
3	1	2	1	-.8716-01	-.2505-01	.3125+01	.6667+01	.0000	-.6250+00	-.3333+01	.0000	-.6250+00	.3333+01	.0000
3	1	2	2	-.8716-01	.1072+00	.3125+01	.6667+01	.0000	-.6250+00	.3333+01	.0000	-.6250+00	.1000+02	.0000

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 5 PAGE  
 VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 0 1 0 5 ALFA= 5.00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 16

J	K	NP	NG	VFS(MAT)	VIN(MAT)	P(X)	P(Y)	P(Z)	B(X)	B(Y)	B(Z)	D(X)	D(Y)	D(Z)
3	1	2	3	-.8716-01	-.3346-01	.3125+01	.6667+01	.0000	.5616+01	-.3333+01	.1085+00	.5616+01	.3333+01	.1085+00
3	1	2	4	-.8716-01	.2002-01	.3125+01	.6667+01	.0000	.5616+01	.3333+01	.1085+00	.5625+01	.1000+02	.0000
2	2	3	1	-.2588+00	.9435-01	.6847+01	-.8960-07	.3256+00	-.6250+00	-.3333+01	.0000	-.6250+00	.3333+01	.0000
2	2	3	2	-.2588+00	-.5275-01	.6847+01	-.8960-07	.3256+00	-.6250+00	.3333+01	.0000	-.6250+00	.1000+02	.0000
2	2	3	3	-.2588+00	.1814+00	.6847+01	-.8960-07	.3256+00	.5616+01	-.3333+01	.1085+00	.5616+01	.3333+01	.1085+00
2	2	3	4	-.2588+00	-.3772-01	.6847+01	-.8960-07	.3256+00	.5616+01	.3333+01	.1085+00	.5625+01	.1000+02	.0000
3	2	4	1	-.8716-01	-.2831-01	.6875+01	.6667+01	.0000	-.6250+00	-.3333+01	.0000	-.6250+00	.3333+01	.0000
3	2	4	2	-.8716-01	.9421-01	.6875+01	.6667+01	.0000	-.6250+00	.3333+01	.0000	-.6250+00	.1000+02	.0000
3	2	4	3	-.8716-01	-.1977-01	.6875+01	.6667+01	.0000	.5616+01	-.3333+01	.1085+00	.5616+01	.3333+01	.1085+00
3	2	4	4	-.8716-01	.1795+00	.6875+01	.6667+01	.0000	.5616+01	.3333+01	.1085+00	.5625+01	.1000+02	.0000

## LIFT DISTRIBUTION DETAIL-SURFACE NO.= 1/( 1, 1)

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J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
1	1	-.625	-6.667	.000	50.0000	.3925	.08384	.00000	.99673	.00054	.00568	.00332	-.1472+01
1	2	5.620	-6.667	.054	16.6667	.0302	-.00380	-.01627	.99893	.00267	-.00472	.09088	-.3780-01
2	1	-.625	-.000	.000	50.0000	.3178	-.01521	.00000	1.00160	.00541	.00000	.10236	-.1192+01
2	2	5.616	-.000	.109	16.6667	.9942	-.01031	.00000	.99872	.00253	.00000	.09747	-.1243+01
3	1	-.625	6.667	.000	50.0000	.3925	.08384	.00000	.99673	.00054	-.00568	.00332	-.1472+01
3	2	5.620	6.667	.054	16.6667	.0302	-.00380	.01627	.99893	.00267	.00472	.09088	-.3780-01

## SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/( 1, 1)

\*\*\*\*\*

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
2	-.0000	-.000	.000	.000	.4870	.0062	.4846	.0430	-.1245	.2423	.0103	.0000	-.9999
3	.3333	6.667	.000	6.667	.3010	-.0247	.3020	.0241	.0141	.1510	.0038	-.0163	-.9999

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 5 PAGE  
 VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 0 1 0 5 ALFA= 5.00 MACHNO= .0000 ALTITUDE=\*\*\*\*\* 17

## INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 1

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E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
1	.0164	.0164	.0000	.0149	.0178	.0041	-.0000	.0000	.00	.00	200.00	10.00	20.00
*** AIRLOAD SUMS ***													
AC	.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
CC	.0172	-.0029	.0000	.0726	.0035	-.0006	-.0000	-.0000	.00	.00	1000.00	100.00	100.00
AC	.0164	.0164	.0000	.0149	.0178	.0041	-.0000	.0000	.00	.00	200.00	10.00	20.00
CC	.0033	.0033	.0000	.0030	.0036	.0001	-.0000	.0000	.00	.00	1000.00	100.00	100.00

\* DETERMINANT= .1073+02 \* SCALE= .7042-01 \*

\*\*\*\* JOB TIME= 1 / ELAPSED TIME= 4 / NO.PLOT FILES= 0 / NSURF EXEC. VERSION 6-18-72 \*\*\*\*

\*\*\*\*\*

## 6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO. 5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20) = 8 PAGE  
 VALUE 3 0 0 0 0 2 0 0 0 0 1 0 0 0 0 0 0 0 1 0 8 ALFA = .00 MACHNO = .0000 ALTITUDE = \*\*\*\*\* 20

	XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
	.0000	1.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
.0300	.0000	.0300	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0300	10.0000	.0300	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

J	K	Y	Z	WL	EW	DWL	DC	DS
1	1	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.800+00	5.000+01
2	1	-5.960-08	0.000	0.000	0.000	6.667+00	7.800+00	5.000+01
3	1	6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.800+00	5.000+01
1	2	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.500+00	1.667+01
2	2	-5.960-08	0.000	0.000	0.000	6.667+00	2.500+00	1.667+01
3	2	6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.500+00	1.667+01

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
1	1	-6.250-01	-1.000+01	0.000	0.000	1.000+00	0.000	3.125+00	-6.667+00	0.000	0.000	0.000	1.000+00
2	1	-6.250-01	-3.333+00	0.000	0.000	1.000+00	0.000	3.125+00	-5.960-08	0.000	0.000	0.000	1.000+00
3	1	-6.250-01	3.333+00	0.000	0.000	1.000+00	0.000	3.125+00	6.667+00	0.000	0.000	0.000	1.000+00
1	2	5.625+00	-1.000+01	0.000	0.000	1.000+00	0.000	6.875+00	-6.667+00	0.000	0.000	0.000	1.000+00
2	2	5.625+00	-3.333+00	0.000	0.000	1.000+00	0.000	6.875+00	-5.960-08	0.000	0.000	0.000	1.000+00
3	2	5.625+00	3.333+00	0.000	0.000	1.000+00	0.000	6.875+00	6.667+00	0.000	0.000	0.000	1.000+00

```

$DEBUG1
P = .31250000E+01, -.59604645E-07, .00000000E+00,
B = -.62500000E+00, .33333333E+01, .00000000E+00,
D = -.62500000E+00, .33333333E+01, .00000000E+00,
TANA = -.43660927E-01,
GAMA = .79577538E-01,
PSIF = .34891974E+01,
VCOS = .15201368E+00, -.17101539E+00, .34816869E+01,
SEND
$DEBUG2
PSIF = -.34891974E+01,
VCOS = .30402735E+00, .00000000E+00, .69633738E+01,
SEND

```

```

$DEBUG3
PSIF = .23621825E+01,
VCOS = .30402735E+00, .00000000E+00, .93255563E+01,
SEND
VORTEX LATTICE MATRIX DETAIL-SURFACE NO. = 1/( 1, 1)
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J	K	NP	NG	VFS(MAT)	VIN(MAT)	P(X)	P(Y)	P(Z)	B(X)	B(Y)	B(Z)	D(X)	D(Y)	D(Z)
2	1	1	1	-.8716-01	.1113+00	.3125+01	-.5960-07	.0000	-.6250+00	-.3333+01	.0000	-.6250+00	.3333+01	.0000

```

$DEBUG1
P = .31250000E+01, -.59604645E-07, .00000000E+00,
B = -.62500000E+00, .33333333E+01, .00000000E+00,
D = -.62500000E+00, .33333333E+01, .00000000E+00,
TANA = -.43660927E-01,
GAMA = .79577538E-01,
PSIF = .34891975E+01,
VCOS = -.15201368E+00, -.17101540E+00, -.34816870E+01,
SEND
$DEBUG2
PSIF = -.90040575E+00,
VCOS = -.11274380E+00, -.15628919E+00, -.25822586E+01,
SEND
$DEBUG3
PSIF = .48349399E+00,
VCOS = -.11274380E+00, -.15628919E+00, -.20987647E+01,
SEND

```

```

$DEBUG1
P = .31250000E+01, -.59604645E-07, .00000000E+00,
B = -.62500000E+00, .33333333E+01, .00000000E+00,
D = -.62500000E+00, .33333333E+01, .00000000E+00,
TANA = -.43660927E-01,
GAMA = .79577538E-01,
PSIF = .60046574E+00,
VCOS = .39269878E-01, -.14726204E-01, .89942843E+00,
SEND
$DEBUG2
PSIF = -.34891976E+01,
VCOS = -.11274381E+00, .15628920E+00, -.25822587E+01,
SEND
$DEBUG3
PSIF = .48349399E+00,
VCOS = -.11274381E+00, .15628920E+00, -.20987647E+01,
SEND

```

## 6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

```

PSIF = .46490990E-02,
VCOS = -.70147196E-02, -.49002356E-02, -.26632830E+00,
SEND

```

```

$DEBUGV1
P = .56202524E+01, .66666664E+01, .54269035E-01,
B = .56159049E+01, .33333332E+01, .10853007E+00,
D = .56159049E+01, .33333332E+01, .10853007E+00,
TANA = -.43660927E-01,
GAMA = .79577538E-01,
PSIF = .66713168E+00,
VCOS = .29099439E-01, .36028789E-02, .66648699E+00,
SEND
$DEBUGV2
PSIF = -.20040093E+01,
VCOS = -.58302713E-01, -.28861600E-01, -.13353522E+01,
SEND
$DEBUGV3
PSIF = .14523004E-01,
VCOS = -.43435699E-01, -.28861600E-01, -.13340865E+01,
SEND

```

```

$DEBUGV1
P = .56202524E+01, .66666664E+01, .54269035E-01,
B = .56159049E+01, .33333332E+01, .10853007E+00,
D = .56250000E+01, .99999996E+01, .00000000E+00,
TANA = -.43660927E-01,
GAMA = .79577538E-01,
PSIF = .20042719E+01,
VCOS = .47413603E-01, .32468731E-01, .20021014E+01,
SEND
$DEBUGV2
PSIF = -.20042719E+01,
VCOS = .17482721E+00, .64937462E-01, .40042028E+01,
SEND
$DEBUGV3
PSIF = .00030000E+00,
VCOS = .17482721E+00, .64937462E-01, .40042028E+01,
SEND

```

LIFT DISTRIBUTION DETAIL-SURFACE NO.= 1/( 1, 1)

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J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
1	1	-.625	-8.667	.000	50.0000	.3925	.08384	.00000	.99673	.00054	.00568	.00332	-.1472+01
1	2	5.620	-6.667	.054	16.6667	.0302	-.00380	-.01627	.99893	.00267	-.00472	.09088	-.3780-01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)\* 8 PAGE 21

VALUE 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

ALFA= 5.00 MACHNO= .0000 ALTITUDE=\*\*\*\*\*

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
2	1	-.625	-.000	.000	50.0000	.3178	-.01521	.00000	1.00160	.00541	.00000	.10236	-.1192+01
2	2	5.616	-.000	.109	16.6667	.9942	-.01031	.00000	.99872	.00253	.00000	.09747	-.1243+01
3	1	-.625	6.667	.000	50.0000	.3925	.08384	.00000	.99673	.00054	-.00568	.00332	-.1472+01
3	2	5.620	6.667	.054	16.6667	.0302	-.00380	.01627	.99893	.00267	.00472	.09088	-.3780-01

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/( 1, 1)

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J	Y*	Y	Z	W	SCN	SCX	SCY	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
2	-.0000	-.000	.000	.000	.4870	.0062	.4846	.0430	-.1245	.2423	.0103	.0000	-.9999
3	.3333	6.667	.000	6.667	.3010	-.0247	.3020	.0241	.0141	.1510	.0038	-.0163	-.9999

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 1

\*\*\*\*\*

E	ECN	ECX	ECY	ECL	ECO	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.3636	-.0144	.0000	.3629	.0175	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
1	.0164	.0164	.0000	.0149	.0178	.0041	-.0000	.0000	.00	.00	200.00	10.00	20.00

\*\*\* AIRLOAD SUMS \*\*\*

AC	.3636	-.0144	.0000	.3629	.0175	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
CC	.0726	-.0129	.0000	.0726	.0035	-.0006	-.0000	-.0000	.00	.00	100.00	10.00	10.00
CG	.0164	.0164	.0000	.0149	.0178	.0041	-.0000	.0000	.00	.00	200.00	10.00	20.00
CG	.0033	.0033	.0000	.0030	.0036	.0001	-.0000	.0000	.00	.00	100.00	10.00	10.00

\* DETERMINANT= .1073+02 \* SCALE= .7042-01 \*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)\* 8 PAGE 22

VALUE 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

ALFA= 5.00 MACHNO= .0000 ALTITUDE=\*\*\*\*\*

\*\*\* JOB TIME= 3 / ELAPSED TIME= 7 / NO.PLOT FILES= 0 / NSURF EXEC, VERSION 6-10-72 \*\*\*

\*\*\*\*\*

#### 6.6 EXAMPLE PROBLEM # 5. DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	EXAMPLE NO. 5 - DEBUG-DUMP DEMONSTRATION/ NPLG(20) 10	PAGE 25
VALUE	3	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	1	1	0	16	ALFA = .000 MACHNO = .0000 ALTITUDE*****	

[illegible][illegible]

J	K	Y	Z	WL	EW	DWL	DC	DS
1	1	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.500+00	5.000+01
2	1	-5.968-08	0.000	0.000	0.000	6.667+00	7.500+00	5.000+01
3	1	6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.500+00	5.000+01
1	2	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.500+00	1.667+01
2	2	-5.968-08	0.000	0.000	0.000	6.667+00	2.500+00	1.667+01
3	2	6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.500+00	1.667+01

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
1	1	-6,250-01	-1,000+01	0,000	0,000	1,000+00	0,000	3,125+00	-6,667+00	0,000	0,000	0,000	1,000+00
2	1	-6,250-01	-3,333+00	0,000	0,000	1,000+00	0,000	3,125+00	-3,969-08	0,000	0,000	0,000	1,000+00
3	1	-6,250-01	3,333+00	0,000	0,000	1,000+00	0,000	3,125+00	6,667+00	0,000	0,000	0,000	1,000+00
1	2	5,625+00	-1,000+01	0,000	0,000	1,000+00	0,000	6,875+00	-6,667+00	0,000	0,000	0,000	1,000+00
2	2	5,625+00	-3,333+00	0,000	0,000	1,000+00	0,000	6,875+00	-3,969-08	0,000	0,000	0,000	1,000+00
3	2	5,625+00	3,333+00	0,000	0,000	1,000+00	0,000	6,875+00	6,667+00	0,000	0,000	0,000	1,000+00

```

$DBGV1
P      =      ,31250000E+01,      -,59604645E+07,      ,00000000E+00,
B      =      -,62500000E+00,      -,33333333E+01,      ,00000000E+00,
D      =      -,62500000E+00,      ,33333332E+01,      ,00000000E+00,
TANA   =      -,43686927E-01,
GAMA   =      ,79577538E-01,
PSIF   =      ,34891974E+01,
VCOS   =      ,15201388E+00,      -,17101539E+00,      ,34816869E+01,
$END
$DBGV2
PSIF   =      -,34891974E+01,
VCOS   =      ,30402735E+00,      ,00000000E+00,      ,69633738E+01,
$END

```

```

$OBUGV3
PSIF      =      ,23621825E+01,
VCQS      =      ,30402735E+00,      ,00000000E+00,      ,93255563E+01,
$END

```

```
$REFLEX
PX      =      .00000000E+00,
PY      =     -.62500000E+00,
X1      =     .10030198E+05,
Y1      =     .00000000E+00,
PWJ     =     -.87266430E-01,
ALFAAR  =     .87266430E-01,
RX      =     -.10000052E+05,
RY      =     .87429012E+03,
ZL      =     .10000000E+05,
COSR    =     .99619471E+00,
```

```
SEND
SREFLEX
PX      *      .19923998E+05,
PY      *      .17425248E+04,
X1      *      .10038198E+05,
Y1      *      .00000000E+00,
PHI     *      -.8726430E+01,
ALFAR   *      .8726430E+01,
RX      *      .10000000E+00,
RY      *      .87429012E+05,
ZL      *      .10000000E+00,
COSR    *
SEND
```

ABOUT 50 PAGES OF OUTPUT OMITTED

	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
1	.0164*	.0164*	.0000*	.0149*	.0178*	.0041*	-.0000*	.0000*	.00*	.00*	200.00*	10.00*	20.00*
*** AIRLOAD SUMS ***													
AC	.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
CG	.0726	-.0029	.0000	.0726	.0035	-.0006	-.0000	-.0000	.00	.00	100.00	10.00	10.00
AC	.0164*	.0164*	.0000*	.0149*	.0178*	.0041*	-.0000*	.0000*	.00*	.00*	200.00*	10.00*	20.00*
CG	.0033*	.0033*	.0000*	.0030*	.0036*	.0001*	-.0000*	.0000*	.00*	.00*	100.00*	10.00*	10.00*

\* DETERMINANT= .1073+02 \* SCALE= .7042-01 \*

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	EXAMPLE NO. 5 - DEBUG-DUMP DEMONSTRATION/ NFLAG(20) = 16	PAGE
VALUE	3	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	1	1	0	16	27	
ALFA = 5.00 MACHNO = .0000 ALTITUDE*****																						

\*\*\*\* JOB TIME= 6 / ELAPSED TIME= 13 / NO.PLOT FILES= 0 / NSURF EXEC, VERSION 6-18-72 \*\*\*\*

# 6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS (CONTINUED)

XQT NSURFT

24 AUG 72

10°20' 3.974

1.032000+00	7.680000+00	3.030000+00	-2.930000+00	-9.780000-02
7.865000+00	-6.390000+00	-3.380000+00	5.670000+00	7.103000+00
3.216000+00	8.900000+00	-1.167000+01	8.323000+00	9.992000+00
3.031000+00	-1.030000+00	4.180000+00	9.073000+00	9.780000-01
1.032000+01	5.690000+00	-3.600000+00	3.780000-02	1.514000+01

TEST MATRIX = [M]

3.220950-01	2.931715-01	9.424216-03	-8.727428-02	-1.363442-01
1.091531-01	1.619780-03	3.541707-02	1.522940-03	-2.353400-02
-8.700874-02	-1.258476-01	-6.201933-02	1.070551-01	9.243558-02
-2.496730-02	-1.494837-02	3.317090-02	8.115159-02	-2.028226-02
-2.808256-01	-2.303324-01	-3.456437-02	8.417013-02	1.896721-01

INVERSE MATRIX = [M]<sup>-1</sup>

1.000000+00	-3.469447-18	4.336809-19	-1.782157-18	3.469447-18
-8.673617-19	1.000000+00	1.734723-18	-1.029992-18	-8.673617-19
0.000000	8.673617-19	1.000000+00	-2.463172-18	-1.734723-18
4.336809-19	9.757820-19	0.000000	1.000000+00	1.301043-18
3.469447-18	6.938894-18	8.673617-19	-1.565317-18	1.000000+00

UNIT MATRIX = [M] × [M]<sup>-1</sup>

5.870328+04

DETERMINANT

XQT ISURFT

24 AUG 72

10°20' 6.109

1.032000+00	7.680000+00	3.030000+00	-2.930000+00	-9.780000-02
7.865000+00	-6.390000+00	-3.380000+00	5.670000+00	7.103000+00
3.216000+00	8.900000+00	-1.167000+01	8.323000+00	9.992000+00
3.031000+00	-1.030000+00	4.180000+00	9.073000+00	9.780000-01
1.032000+01	5.690000+00	-3.600000+00	3.780000-02	1.514000+01

TEST MATRIX = [M]

3.220950-01	2.931715-01	9.424216-03	-8.727428-02	-1.363442-01
1.091531-01	1.619780-03	3.541707-02	1.522940-03	-2.353400-02
-8.700874-02	-1.258476-01	-6.201933-02	1.070551-01	9.243558-02
-2.496730-02	-1.494837-02	3.317090-02	8.115159-02	-2.028226-02
-2.808256-01	-2.303324-01	-3.456437-02	8.417013-02	1.896721-01

INVERSE MATRIX = [M]<sup>-1</sup>

1.000000+00	-3.469447-18	4.336809-19	-1.782157-18	3.469447-18
-8.673617-19	1.000000+00	1.734723-18	-1.029992-18	-8.673617-19
0.000000	8.673617-19	1.000000+00	-2.463172-18	-1.734723-18
4.336809-19	9.757820-19	0.000000	1.000000+00	1.301043-18
3.469447-18	6.938894-18	8.673617-19	-1.565317-18	1.000000+00

UNIT MATRIX = [M] × [M]<sup>-1</sup>

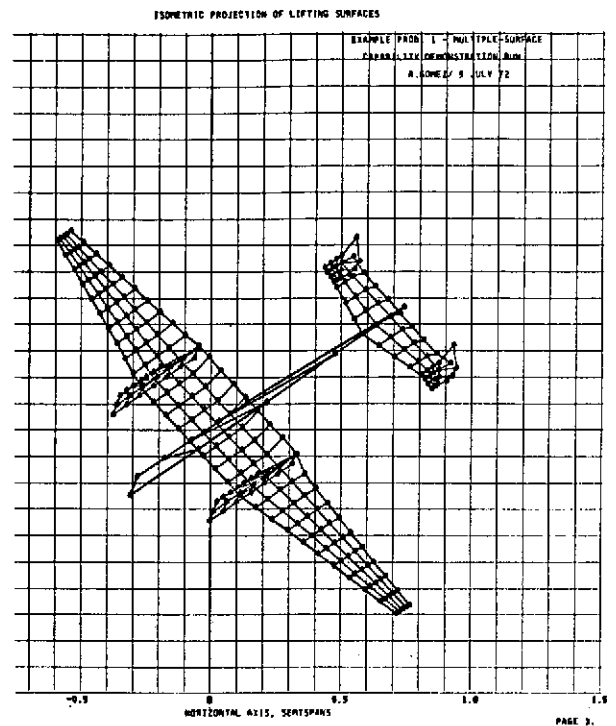
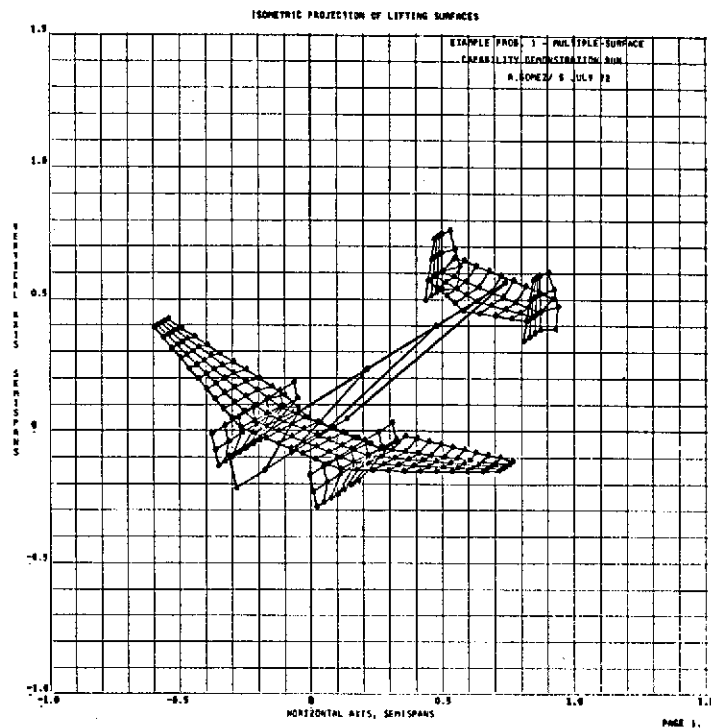
5.870328+04

DETERMINANT



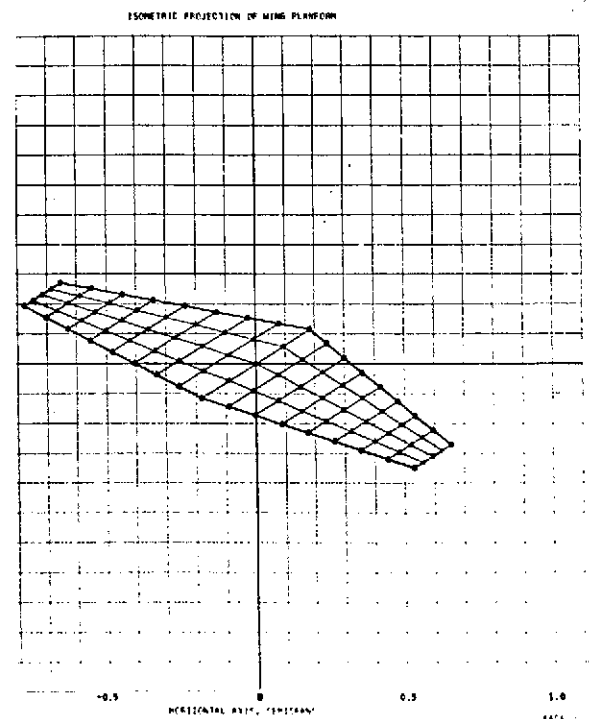
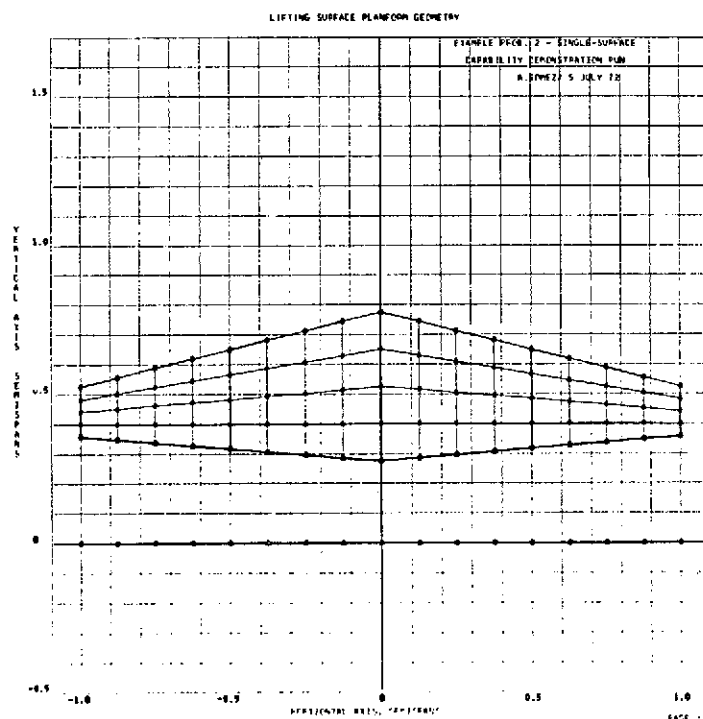
## 6.7 PLOT-OUTPUT

### 1) EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY



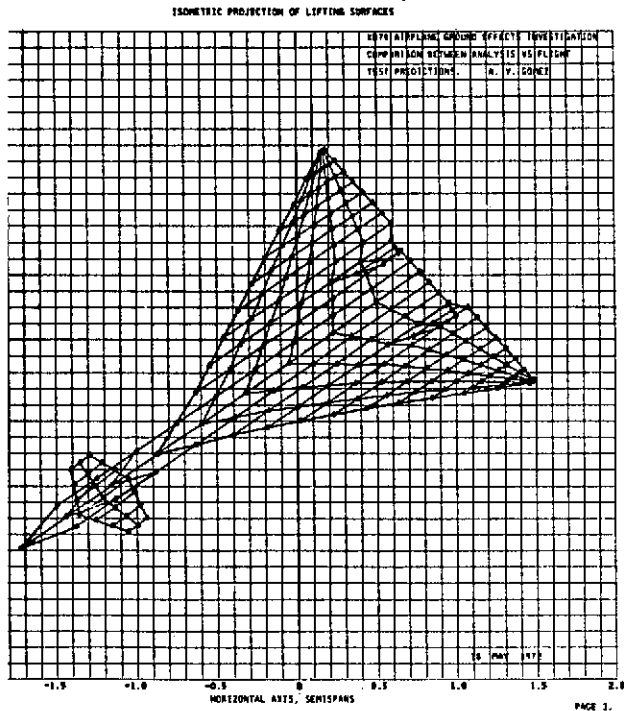
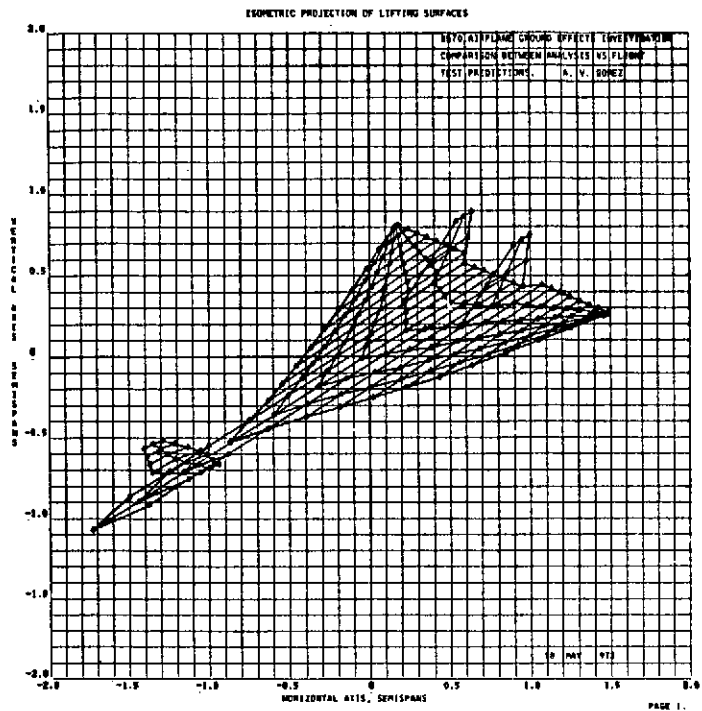
### 2) EXAMPLE PROBLEM # 2, SINGLE-SURFACE ANALYSIS CAPABILITY

NOTE: THE FIRST TWO PLOTS ARE SHOWN BELOW. THE REMAINDER OF THE PLOT-OUTPUT FOR THIS PROBLEM IS PRESENTED IN FIGURE 2.18[C] (PAGES 2-49 THRU. 2-52)

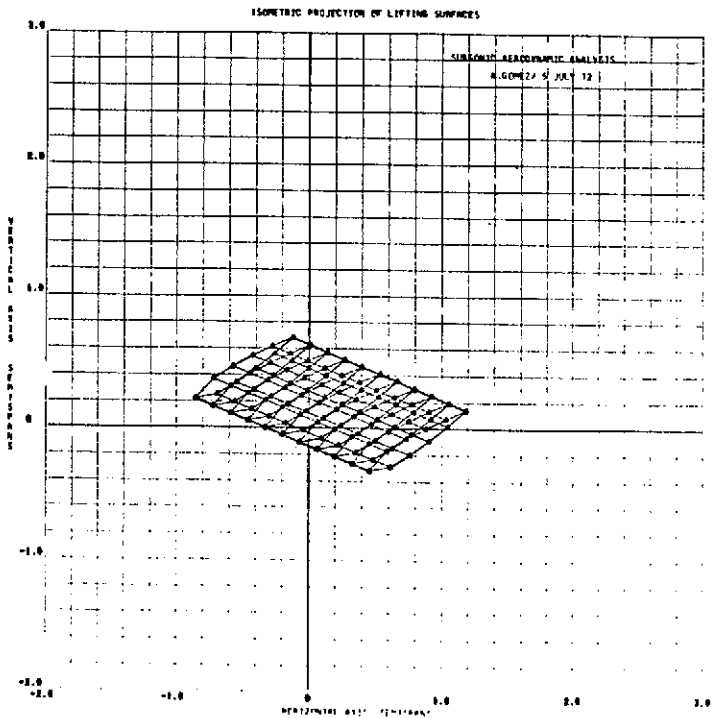


### 6.7 PLOT-OUTPUT (CONTINUED)

## 3) EXAMPLE PROBLEM # 3, NORTH AMERICAN XB-70 AIRPLANE



#### 4) EXAMPLE PROBLEM # 4, THICK-WING ANALYSIS



## 7.0 PROGRAM DESCRIPTION

### 7.1 Operating Procedures

The "TRW Vortex-Analysis Program #HA010B (N. SURFACE)" is written in Fortran V source language for execution in the UNIVAC 1108 computer, with a 65K core or a computer of similar configuration. Five separate execution modes for the program are permitted:

#### 1) XQT ISURF or XQT NSURF

Two main execution modes for solving lifting-surface problems by the vortex-lattice method are permitted. NAMELIST statements are used exclusively for input of numeric quantities along with "A" formatted read statements for titles and comments. Card input and tabular printed output are on units 5 and 6 respectively. In addition to the program PCF tape, which is assigned to an unused unit, the following units\* are also used:

Unit 1 (KT1) Input data is stored in unit 1 for all the cases that are to be executed.

Unit 8 (KT2) Output plot-data tape or drum physical unit assignment that is required as an input for the auxiliary execution mode.

Unit 3 (KT3) Work tape or drum physical unit assignment.

#### 2) XQT ISURFT or NSURFT

Two test execution-modes for determining the accuracy of the matrix inversion procedure are permitted. The test execution-modes require no input data. Tabular printed output is on unit 6.

#### 3) XQT TRWPLT

One auxiliary execution mode that is used for obtaining Calcomp or 4060-microfilm output is permitted. This mode of execution requires two modes of input, a tape or drum file (Unit KT2) containing the plot data accompanied by punched-card input describing the manner in which the data is to be plotted. A generalized input processor is used which compares the input symbols to an internal symbol table and stores the data in the appropriate address. The card format, which is input in unit 5, consists of BCD symbol equivalences to the input data in a free-form mode. Printed output is in unit 6 and plot output on magnetic tape (PLT tape assignment).

---

\*Units, 1, 3, and 3 (KT1, KT2, and KT3) may be reassigned in execution (see input instructions).

# VORTEX-LATTICE ANALYSIS PROGRAM (HA010B)

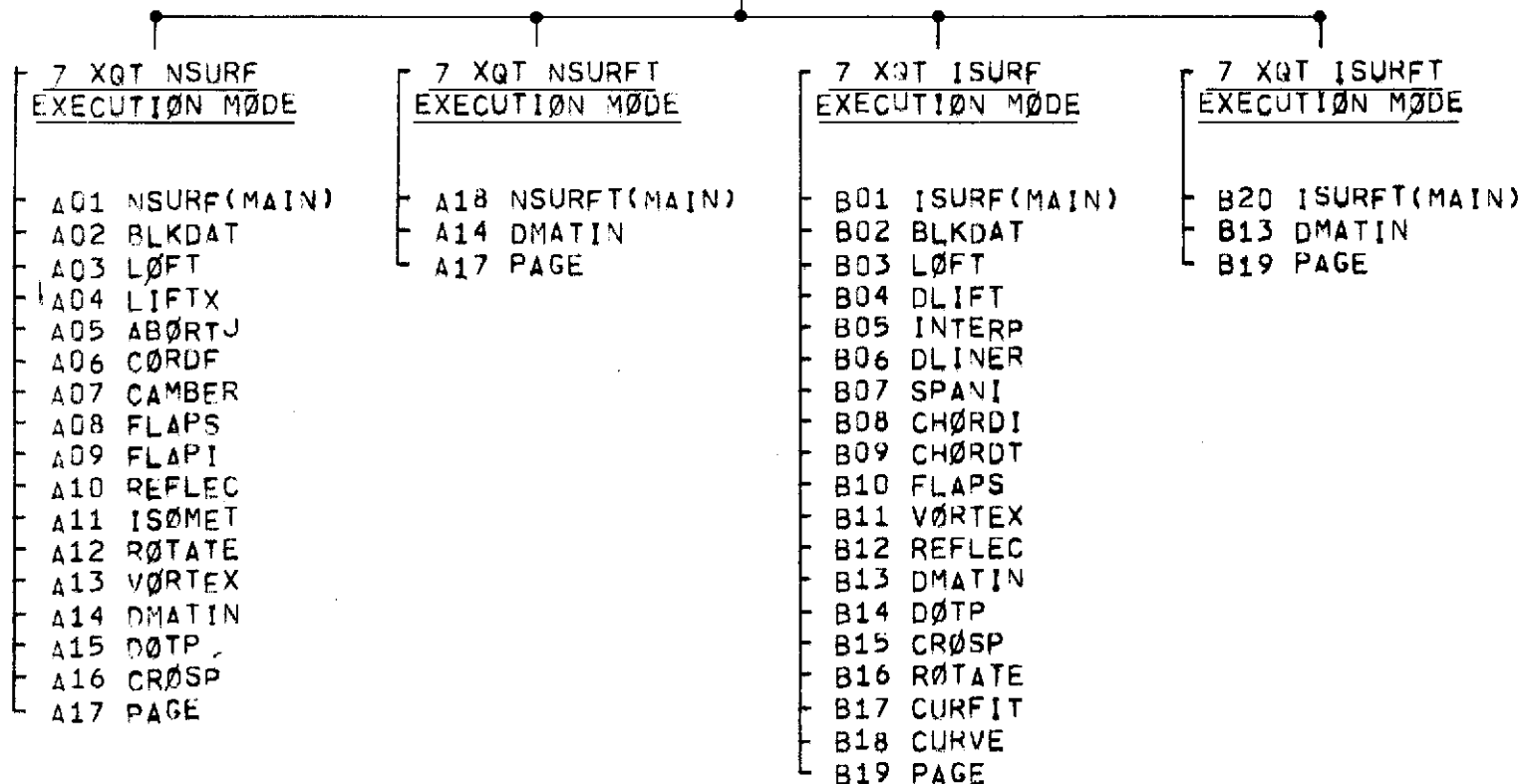


FIGURE 7.01 - TRW VORTEX-LATTICE ANALYSIS PROGRAM OVERLAY STRUCTURE

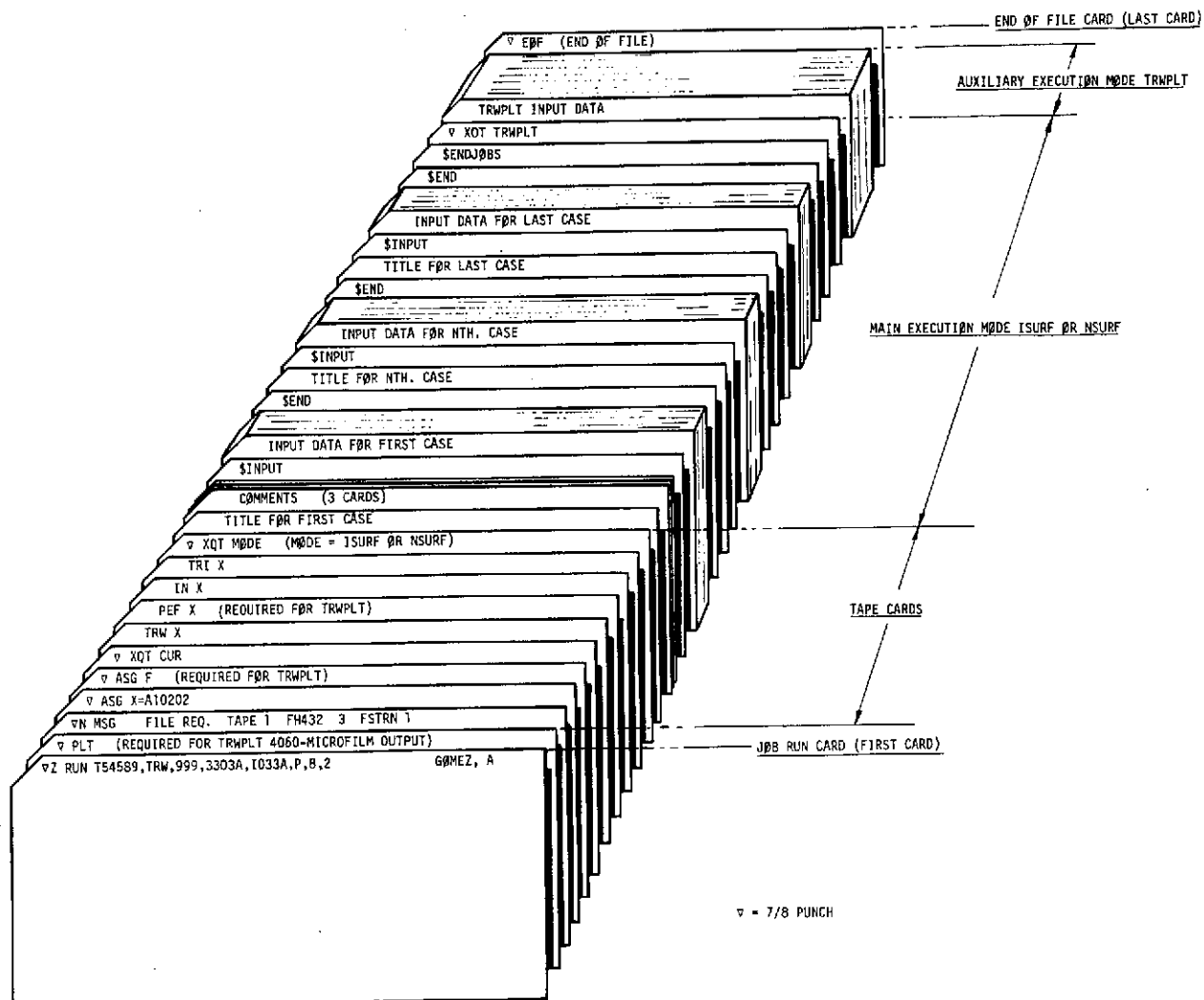


FIGURE 7.02 - CONTROL DECK SETUP

ORIGINAL PAGE IS  
OF POOR QUALITY

## 7.1 Operating Procedures (Continued)

The program overlay diagram for the main and test execution modes is presented in Figure 7.01 (Page 7-2). The program control deck setup is illustrated in Figure 7.02 (Page 7-3).

## 7.2 Execution Time

For the main execution modes of the program, i.e., XQT ISURF or XQT NSURF, the execution time required to complete a single case is primarily dependent on the total number of vortices or elemental surfaces that are considered simultaneously in arriving at a solution. The other factors that affect the execution time are due to the execution of the special options of the program, such as: ground effects, lifting-line extrapolated solutions, tape output, surface discontinuities (flaps or tabs), and the execution of XQT TRWPLT, the auxiliary mode of execution, for obtaining Calcomp or 4060-microfilm plots. A simple but approximate estimate of the total execution time for completing a given job may be determined using:

$$t_{\text{(seconds)}} = \Delta T_1 + N_C \times ( N_g \times \Delta T_{2(N_M)} ) + N_P \times \Delta T_3 \quad (7.2.01)$$

$$N_M = N_S \times \sum_{n=1}^{\text{No. Surfaces}} N_{e,n} \quad (7.2.02)$$

where: $\Delta T_1 = 20$	Time required (seconds) to load the program.
$\Delta T_2 =$	Time required (seconds) to obtain a single vortex-lattice solution (see Figure 7.03).
$\Delta T_3 = 10$	Time required (seconds per plot) for the XQT TRWPLT execution
$N_C =$	Number of cases to complete job.
$N_g \left\{ \begin{array}{l} = 1 \\ = 2 \end{array} \right.$	$\begin{array}{l} \text{No ground effects.} \\ \text{With ground effects.} \end{array}$
$N_P =$	Number of plots.
$N_M =$	Number of elements in the vortex-lattice matrix.
$N_S \left\{ \begin{array}{l} = 1 \\ = 0.5 \end{array} \right.$	$\begin{array}{l} \text{Unsymmetric loading.} \\ \text{Symmetric loading} \end{array}$
$N_{e,n}$	Number of elemental panels for the nth, surface

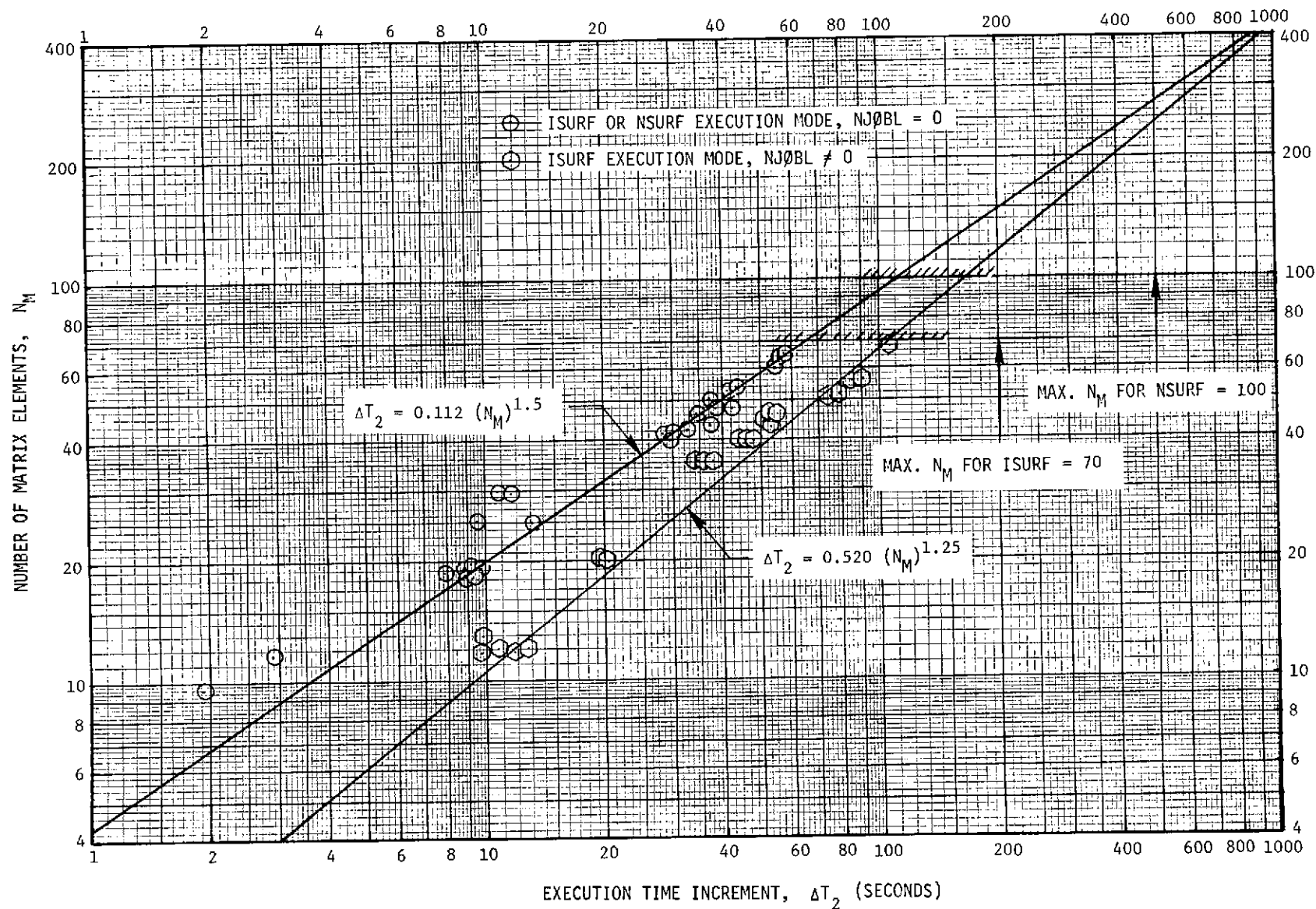


FIGURE 7.03 - EXECUTION TIME INCREMENT  $\Delta T_2$

### 7.3 Program Organization

The present version of the "TRW Vortex-Lattice Analysis Program #HA010B (N.SURFACE)" that is described in this report constitutes an expanded and modified version that was derived from two older prototype programs., i.e., "TRW's Single Surface Vortex-Lattice Analysis Program #HA009A/B (ISURF)," and "TRW's Multiple Surface Vortex-Lattice Analysis Program #HA010A (NSURF)." The prototype programs were developed specifically for analyzing single-surface and multiple-surface configurations respectively. The present version (HA010B) incorporates the same analytical procedures and basically the same source-program code found in the prototype programs and differs only in the input and output format that is used. In addition, the "TRW Generalized Plot Program TRWPLT (Reference 35)" is included in the PCF tape for providing Calcomp and 4060-microfilm plot-output. Five separate modes of execution are permitted (see Section 7.1) that include: (1) two main execution modes for solving lifting-surface problems by the vortex-lattice method, (2) two test execution modes for determining the accuracy of the matrix inversion procedures, and (3) one auxiliary execution mode that is used for obtaining Calcomp or 4060-microfilm output. The source program (absolute and symbolics) in the program PCF tape is arranged in the following form:

<u>1st. File</u>	<u>2nd. File</u>	<u>3rd File</u>
(No Plots)	(With Plots)	(Backup)
NSURF	NSURF	NSURF
ISURF	ISURF	ISURF
NSURFT	NSURFT	NSURFT
ISURFT	ISURFT	ISURFT
-	TRWPLT	TRWPLT

The source program for each of the main execution modes (XQT NSURF or SQT ISURF) is organized in the following manner: one main (driver) routine, one block data (initial values) subroutine, one-vortex-lattice-geometry calculation subroutine, one vortex-lattice-solution calculation subroutine, and a number of special purpose calculation subroutines. The functions performed by each category are as follows:



### 7.3 Program Organization (Continued)

#### Main (Driver) Routine

- 1) Read input data (Unit 5) for all cases to be executed and store the input data in a drum file (Unit 1) for later use and initiate calculations by calling the block data subroutine.
- 2) Read data for the first case (or subsequent cases) from the data drum file (Unit 1).
- 3) Call the vortex-lattice-geometry calculation subroutine for determining all the geometric parameters that will be needed.
- 4) Setup angle of attack loop and multiple-surface loop (if applicable) and proceed to obtain the vortex-lattice-solutions by calling the vortex-lattice-solution calculation subroutine.
- 5) Finalize the first case (or subsequent case) by printing the execution elapsed time and the number of plot files created. Go back to #2 and start the execution of the next case.

#### Block Data (Initial Values) Subroutine

- 1) Stores data for the initial values (built-in Tables, see Section 4).

#### Vortex-Lattice-Geometry Calculation Subroutine

- 1) Calculate the geometry of the vortex-lattice for all the lifting surfaces that are defined in the input.
- 2) Calculate the geometric parameters that define each lifting surface, e.g., the lifting surface reference dimensions.
- 3) Output the calculated geometry for each lifting surface.
- 4) Output on tape (Unit 8) the geometry for each lifting-surface using the special format required for the plotting option (XQT TRWPLT).

### 7.3 Program Organization (Continued)

#### Vortex-Lattice-Solution Calculation Subroutine

- 1) Calculate the influence coefficient matrix.
- 2) Invert the influence coefficient matrix and determine the vorticity or circulation for all the vortex-filaments of the lifting surfaces that are considered simultaneously.
- 3) Calculate the airload distribution on each lifting surface and perform all the required summations.
- 4) Calculate the section-airload coefficients and output same as printed output and on tape (Unit 8) if applicable.
- 5) Finalize the calculations by printing the spatially-integrated airloads for each lifting surface and the net airload summations.

#### Special Purpose Calculation Subroutines

- 1) Perform calculations directed towards a limited objective.

The program logic flow diagrams for the main (driver) routine and the principal subroutines of the program are presented in Figures 7.04 through 7.09 following Section 7.5. A description of the functions performed by each individual routine are presented in Sections 7.4 and 7.5.

### 7.4 Program Routines for XQT NSURF

- 1) MAIN ROUTINE (A01) (237 FORTRAN Statements)

This is the main routine or driver routine for the XQT NSURF execution mode of the program that performs solutions for multiple-lifting-surfaces problems by the vortex-lattice method.

- 2) SUBROUTINE BLKDAT (A02) (55 FORTRAN Statements)

This is a block data routine where the initial values (built-in tables) of selected input variables are stored (see Section 4.0).

- 3) SUBROUTINE LØFT (A03) (864 FORTRAN Statements)

Subroutine LØFT constitutes the vortex-lattice geometry calculation routine. In this routine all the geometry calculations are carried out. It includes the setup of the vortex-lattice field point coordinates, unit vectors, areas, etc., and the calculation of the reference dimensions

#### 7.4 Program Routines for XQT NSURF (Continued)

for each lifting surface that is input. Also, as a special option (NFLG(19)  $\neq$  0), the geometry of the vortex-lattice is output on tape or any specified internal unit which is used as the input data-tape in the execution of XQT TRWPLT for generating Calcomp/4060-microfilm plot-output.

##### 4) SUBROUTINE LIFTX (A04) (1,178 FORTRAN Statements)

This is the vortex-lattice-solution calculation subroutine for multiple-surface analysis (XQT NSURF). In this subroutine all the calculations directed towards obtaining a solution for a given vortex-lattice originate, that include: calculate influence coefficients, calculate the circulation strength of the vortex-filaments, etc. In addition, the section airload coefficients, lift distribution, and spatially-integrated sums of airload force and moments are performed.

##### 5) SUBROUTINE ABORTJ (A05) (92 FORTRAN Statements)

All diagnostic and job termination output originates in this subroutine. Tests are performed in this routine for selected key variables during the execution and if unallowable errors are incurred the job execution is aborted.

##### 6) SUBROUTINE CORDF (A06) (60 FORTRAN Statements)

This routine calculates the planform dimensions at a wing station for a lifting surface, e.g.,  $Y$ ,  $X_{LE}$ ,  $X_{TE}$ ,  $C$ ,  $C_f$ ,  $C_{tab}$ , etc., as a function of a function of a dummy argument  $W$ .

##### 7) SUBROUTINE CAMBER (A07) (53 FORTRAN Statements)

Subroutine CAMBER determines the normal coordinate of the median camber line of an airfoil, i.e.,  $Z_a/C$  as a function of  $X_a/C$ .

##### 8) SUBROUTINE FLAPS (A08) (169 FORTRAN Statements)

This routine together with Subroutine FLAPI is used to update the coordinate and unit normal vector (no deflection) of a field point on the surface of a lifting-surface due to flap and/or trim-tab deflection.

##### 9) SUBROUTINE FLAPI (A09) (28 FORTRAN Statements)

See Subroutine FLAPS (#8).

#### 7.4 Program Routines for XQT NSURF (Continued)

10) SUBROUTINE REFLEC (A10) (53 FORTRAN Statements)

Subroutine REFLEC calculates the coordinates of a mirror image of a field point using the ground plane as the mirror plane. It is used in the ground effect analysis for determining the coordinates of the image vortex-lattice.

11) SUBROUTINE ISOMET (A11) (27 FORTRAN Statements)

It transforms the coordinates of a given field point  $P(X,Y,Z)$  to a new coordinate system  $P(X',Y',Z')$  that is used to obtain an isometric projection of the vortex-lattice.

12) SUBROUTINE ROTATE (A12) (45 FORTRAN Statements)

It transforms the coordinates of a given field point  $P(X,Y,Z)$  to a new coordinate system  $P(X',Y',Z')$  involving a prescribed rotation and translation.

13) SUBROUTINE VORTEX (A13) (189 FORTRAN Statements)

Subroutine VORTEX calculates the induced velocity or influence coefficient  $\vec{\psi}$  for a field point  $P(X,Y,Z)$  due to a skew-shaped horseshoe vortex filament of circulation strength  $\Gamma$  defined by the field points  $B(X,Y,Z)$  and  $D(X,Y,Z)$ .

14) SUBROUTINE DMATIN (A14) (149 FORTRAN Statements)

Subroutine DMATIN is a double precision, 100 x 100, matrix inversion routine.

15) SUBROUTINE DOTP (A15) (17 FORTRAN Statements)

It calculates the dot-product of two vectors.

16) SUBROUTINE CROSSP (A16) (20 FORTRAN Statements)

It calculates the vector cross-product of two vectors.

17) SUBROUTINE PAGE (A17) (43 FORTRAN Statements)

This subroutine causes a new page to be started and the job title and job execution flags to be printed at the top of the page in the program execution.

## 7.5 Program Routines for XQT ISURF

18) MAIN ROUTINE (B01) (211 FORTRAN Statements)

Same as #1 (A01) except the solution for a single-lifting-surface is considered exclusively.

19) SUBROUTINE BLKDAT (B02) (55 FORTRAN Statements)

Same as #2 (A02) except the solution for a single-lifting-surface is considered exclusively.

20) SUBROUTINE LOFT (B03) 935 FORTRAN Statements)

Same as #3 (A03) except the solution for a single-lifting-surface is considered exclusively.

21) SUBROUTINE DLIFT (B04) (699 FORTRAN Statements)

Same as #4 (A04) except the solution for a single-lifting-surface is considered exclusively.

22) SUBROUTINE INTERP (B05) (406 FORTRAN Statements)

Subroutine INTERP is used to calculate coefficients from two exact vortex-lattice solutions at different angles of attack. These coefficients are used to generate arrays of approximate solutions that are based on the lifting-line theory linearized analysis technique.

23) SUBROUTINE DLINER (B06) (601 FORTRAN Statements)

Subroutine DLINER calculates arrays of approximate solutions using the coefficients determined by INTERP.

24) SUBROUTINE SPANI (B07) (125 FORTRAN Statements)

This routine is used to calculate constant and variable span spacing of the vortex-lattice elemental panels.

25) SUBROUTINE CHORDI (B08) (77 FORTRAN Statements)

Subroutine CHORDI calculates constant or cosine spacing of the vortex-lattice elemental panels in the chordwise direction.

26) SUBROUTINE CHORDT (B09) (44 FORTRAN Statements)

Same as #6 (A06) except the presence of a trim-tab has been omitted.

## 7.5 Program Routines for XQT ISURF (Continued)

27) SUBROUTINE FLAPS (B10) (93 FORTRAN Statements)

Same as #8 (A08) except the presence of a trim-tab has been omitted.

28) SUBROUTINE VORTEX (B11) (190 FORTRAN Statements)

Equivalent to #13 (A13).

29) SUBROUTINE REFLEC (B12) (50 FORTRAN Statements)

Equivalent to #10 (A10)

30) SUBROUTINE DMATIN (B13) (149 FORTRAN Statements)

This is a double precision, 70 x 70, matrix inversion routine.

31) SUBROUTINE DOTP (B14) (18 FORTRAN Statements)

Equivalent to #15 (A15).

32) SUBROUTINE CROSP (B15) (21 FORTRAN Statements)

Equivalent to #16 (A16).

33) SUBROUTINE ROTATE (B16) (46 FORTRAN Statements)

Equivalent to #12 (A12).

34) SUBROUTINE CURFIT (B17) (103 FORTRAN Statements)

The CURFIT routine calculates the coefficients of cubics that are used by the CURVE subroutine.

35) SUBROUTINE CURVE (B18) (58 FORTRAN Statements)

Using the coefficients of cubics calculated by the CURFIT subroutine, the subroutine CURVE determines the value and the derivative of a given function at selected values of the independent variable. CURVE together with CURFIT constitute a spline point (cubic), continuous derivative, interpolation procedure used in the program.

36) SUBROUTINE PAGE (B19) (40 FORTRAN Statements)

Same as #17 (A17), except, the title and the job execution flag IFLG used in XQT ISURF are output.

## 7.6 Program Routines for XQT NSURFT and ISURFT

37) MAIN ROUTINE (A18) (76 FORTRAN Statements)

This routine performs a matrix-inversion test by calculating the inverse-matrix and the unit-matrix using the values of a 5 x 5 built-in matrix.

38) MAIN ROUTINE (B20) (76 FORTRAN Statements)

Equivalent to #37 (A18).

## 7.7 Program-Logic Flow Diagrams

The program-logic flow diagrams for the main (driver) routines and the most important calculation routines that are used in the main execution modes (XQT NSURF and XQT ISURF) are presented in Figures 7.04 through 7.06 (see Pages 7.14 through 7.19).

A) MAIN ROUTINE (A01)

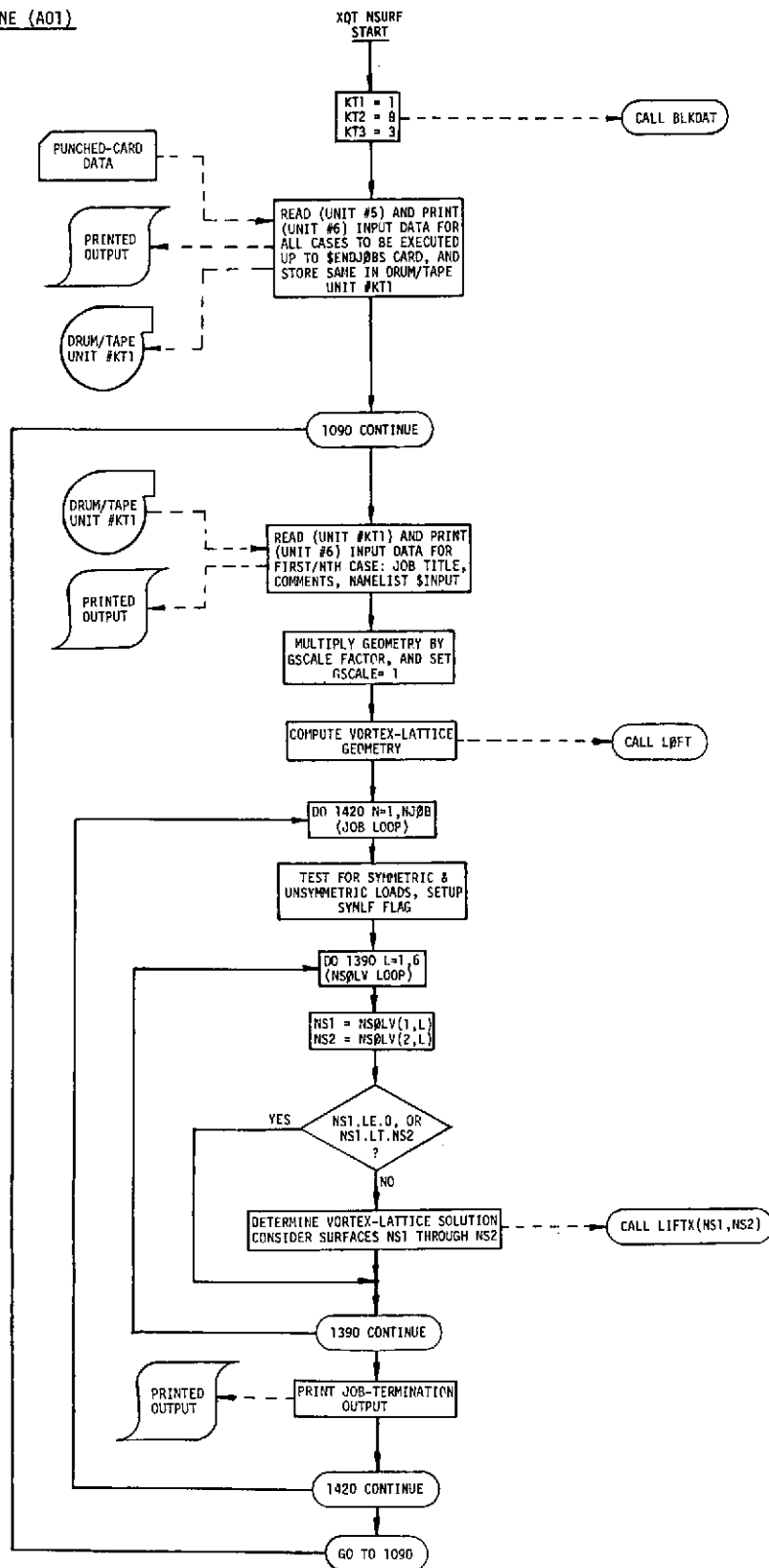


FIGURE 7.04 - LOGIC-FLW-DIAGRAMS FOR THE MAIN (DRIVER) EXECUTION ROUTINES  
(PROGRAM HA010B)

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B) MAIN ROUTINE (B01)

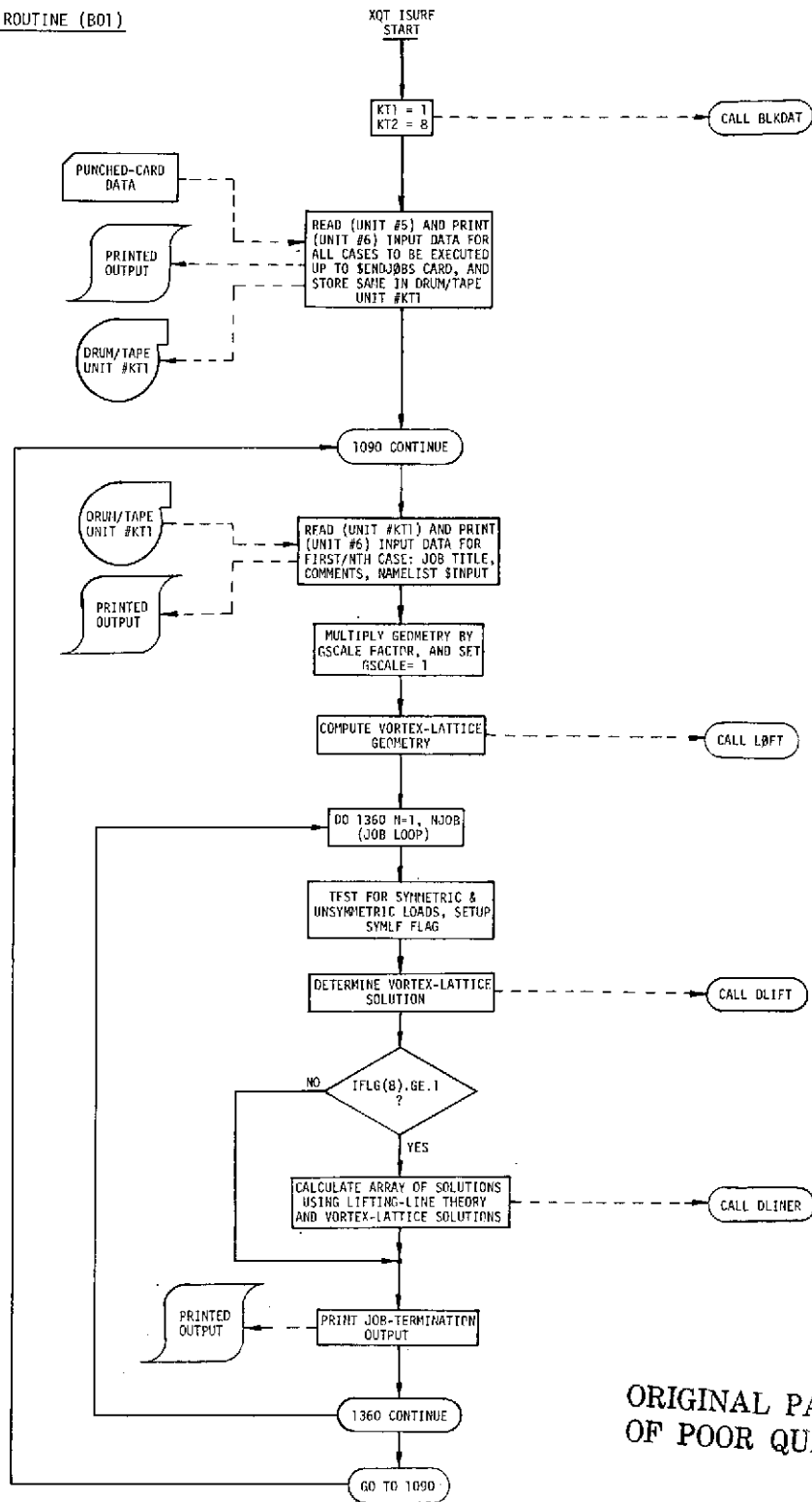


FIGURE 7.04 - LOGIC-FLOW-DIAGRAMS FOR THE MAIN (DRIVER) EXECUTION ROUTINES  
(PROGRAM HA010B) [CONTINUED]

A) SUBROUTINE LØFT (A03)

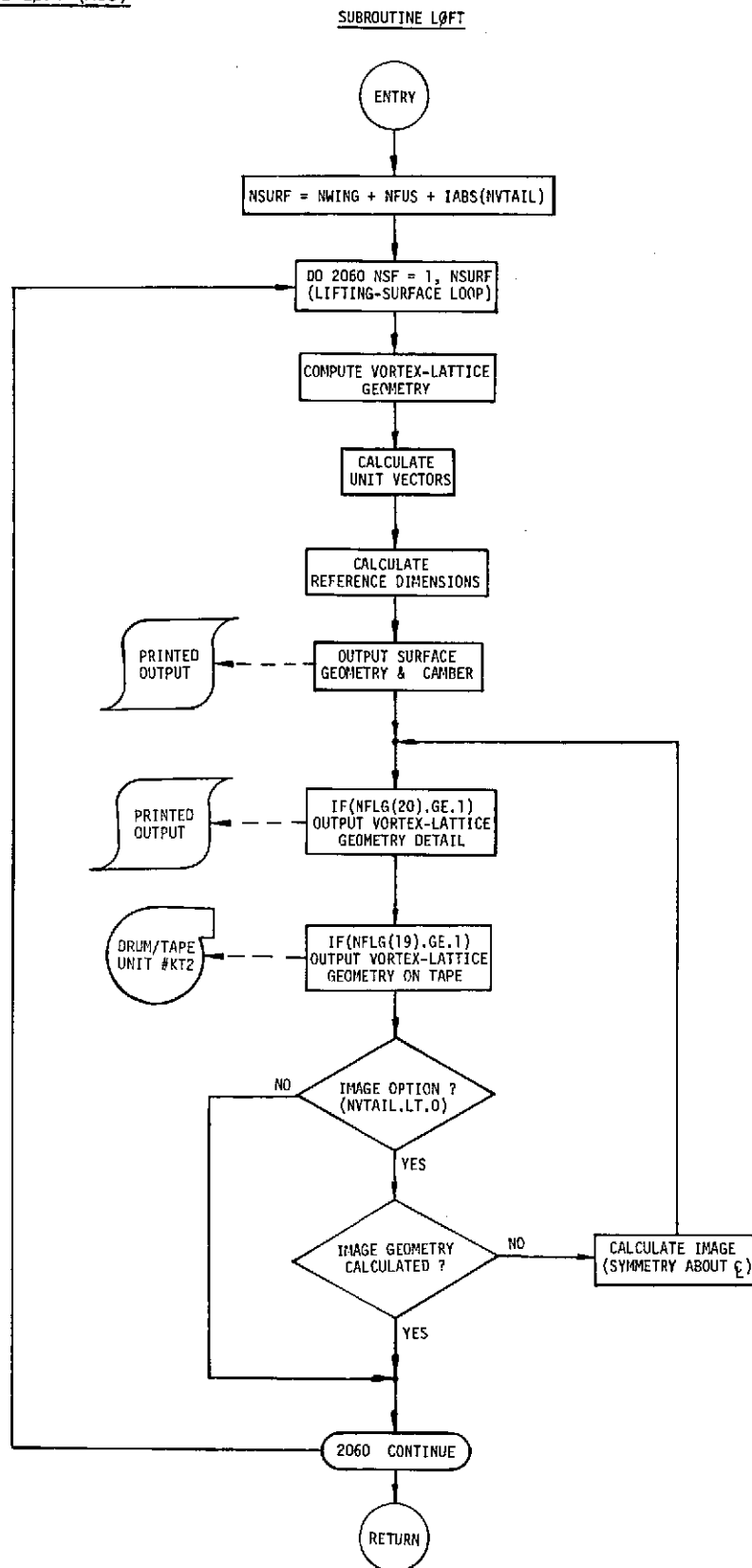


FIGURE 7.05 - LOGIC-FLOW-DIAGRAMS FOR THE VORTEX-LATTICE GEOMETRY CALCULATION  
ROUTINES (PROGRAM HA010B)

B) SUBROUTINE LOFT (B03)

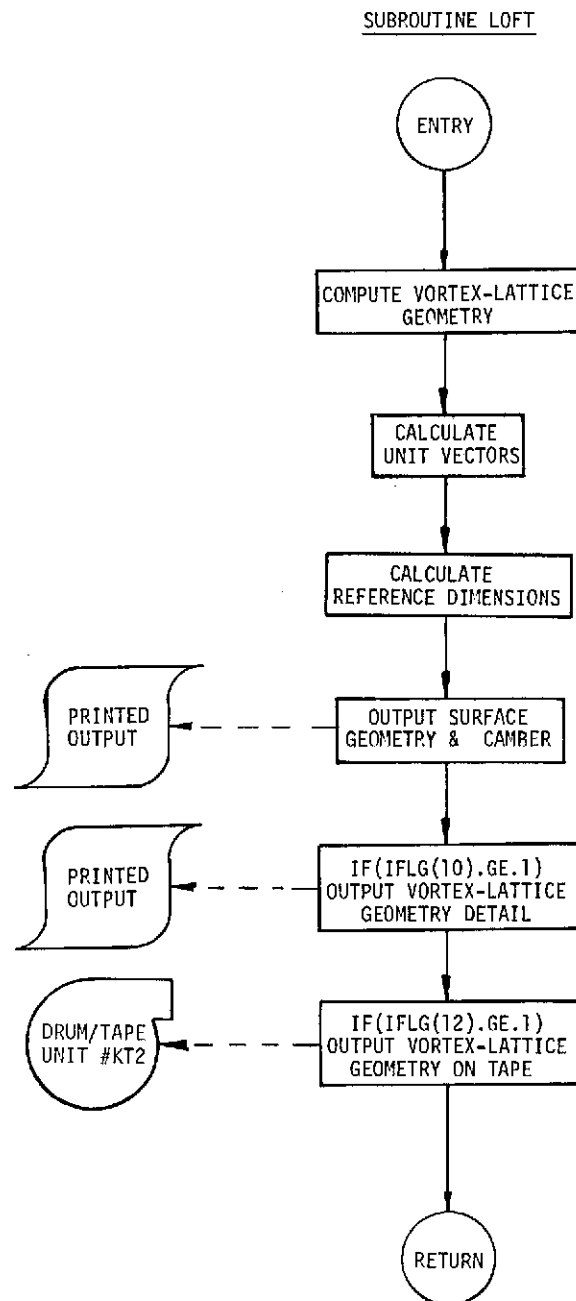
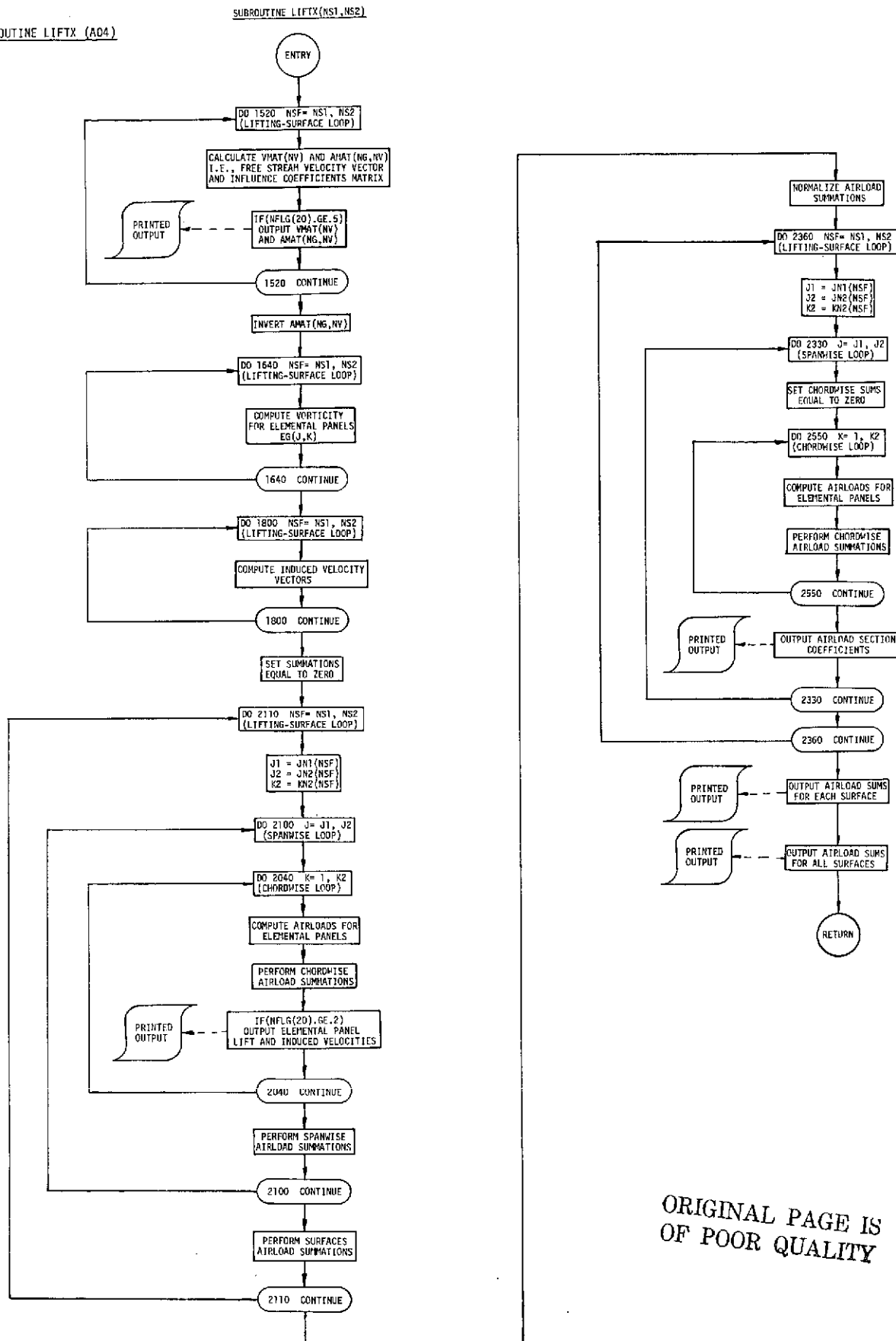


FIGURE 7.05 - LOGIC-FLOW-DIAGRAMS FOR THE VORTEX-LATTICE GEOMETRY CALCULATION ROUTINES (PROGRAM HA010B) [CONTINUED]

4) SUBROUTINE LIFTX (A04)



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FIGURE 7.06 - LOGIC-FLOW-DIAGRAMS FOR THE VORTEX-LATTICE SOLUTION CALCULATION  
ROUTINES (PROGRAM HAD10B)

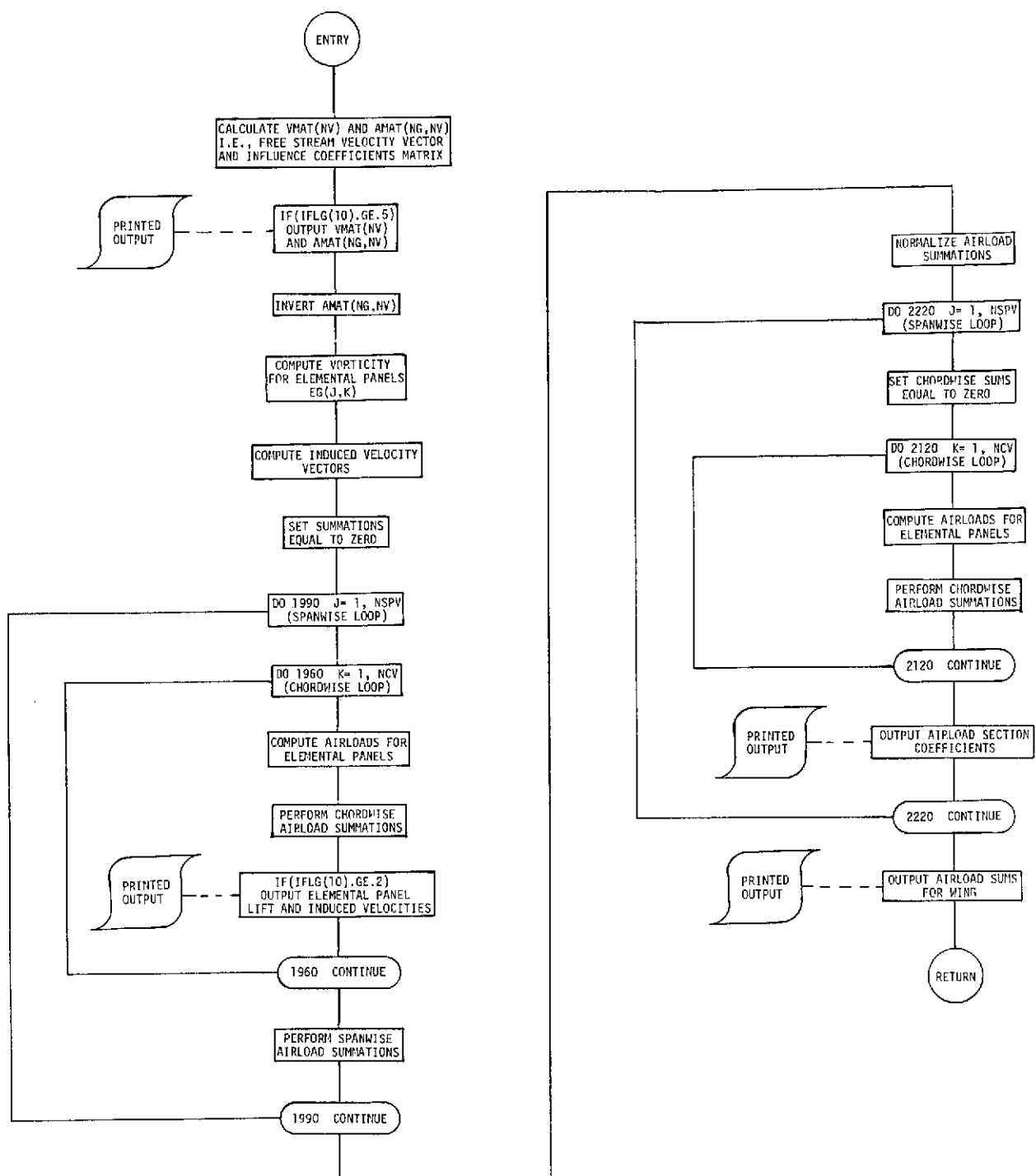


FIGURE 7.06 - LOGIC-FLOW-DIAGRAMS FOR THE VORTEX-LATTICE SOLUTION CALCULATION  
ROUTINES (PROGRAM HAO10R) [CONTINUED]

## 8.0 REFERENCES

1. Robinson, A. and J. A. Laurmann, Wing Theory, Cambridge University Press, G. B., 1956, pp. 169-316.
2. Milne-Thompson, L. M., Theoretical Aerodynamics, MacMillan and Company, Ltd., Third Edition 1958, Chapters 9 through 12.
3. Kuethe, A. M. and J. D. Schetzer, Foundations of Aerodynamics, J. Wiley and Sons, New York, Second Edition 1961, Chapters 5 and 6.
4. Landahl, M. T. and V.J.E. Stark, "Numerical Lifting-Surface Theory- Problems and Progress," AIAA Journal, Vol. 6, N. 11, Nov. 1968, pp. 2049-2060.
5. Kalman, T. P., J. P. Giesing, and W. P. Rodden, "Spanwise Distribution of Induced Drag in Subsonic Flow by the Vortex-Lattice Method," J. Aircraft, V. 7, N. 6, Nov.-Dec. 1970, pp. 574-576.
6. James, R. M., "On the Remarkable Accuracy of the Vortex-Lattice Discretization in Thin Wing Theory," McDonnell Douglas Report No. DAC 67211, Feb. 1969.
7. Weissinger, J., "The Lift Distribution of Swept-Back Wings," NACA Technical Memorandum No. 1120, March 1947, pp. 1-7.
8. Gomez, A. V., "Interim Documentation and Qualification Tests for TRW's Vortex-Lattice Method Computer Program HA009A/B - Subsonic Aerodynamic Analysis of Single Wing Lifting Surfaces of Arbitrary Configurations," TRW Systems Rept. 71.4352.30-6, June 1971.
9. Gomez, A. V., "Interim Documentation and Qualification Tests for TRW's Wake II Digital Computer Program HA001B, Subsonic Aerodynamics Wing Wake Analysis Program," TRW Systems Rept. 70.4352.30-3, May 1970.
10. Dulmovits, J., "A Lifting Surface Method for Calculating Load Distributors and the Aerodynamic Influence Coefficients Matrix for Wings in Subsonic Flow," Grumman Report ADR 01-02-64.1, Aug. 1964.
11. Margason, Richard J., and J. E. Lamar, "Vortex-Lattice Fortran Program for Estimating Subsonic Aerodynamic Characteristics of Complex Planforms," NASA TN D-6142, Feb. 1971.
12. Polhamus, Edward C., "Predictions of Vortex-Lift Characteristics by a Leading-Edge Suction Analogy," J. Aircraft, V. 8, N. 4, April 1971, pp. 193-199.
13. Polhamus, Edward C., "A Concept of the Vortex Lift of Sharp-Edge Delta Wings Based on a Leading-Edge-Suction Analogy," NASA TN D-3767, 1966.

14. Mangler, K. W. and J.H.B. Smith, "A Theory of the Flow Past a Slender Delta Wing with Leading Edge Separation," Proc. Roy. Soc. A.251, pp. 200-217, 1959.
15. Legendre, R., "Vortex Sheets Rolling-up Along Leading-Edges of Delta Wings," in Progress in Aeronautical Sciences, Vol. 7. D. Kuchemann, et al., ed., Pergamon Press, New York, 1966.
16. Smith, J.H.B., "Improved Calculations of the Leading-Edge Separation from Slender, Thin, Delta Wings," Proc. Roy. Soc. A. 306, pp. 67-90, 1968.
17. "ANC-1(1), Spanwise Air-Load Distribution," Army-Navy-Commerce Committee on Aircraft Requirements, U. S. Govt. Printing Office, 1938.
18. Jacobs, E. N, and R. V. Rhode, "Airfoil Section Characteristics as Applied to the Prediction of Air Forces and Their Distribution on Wings.," NACA Report No. 631, 1938.
19. Wagner, S., "Some Recent Developments in Subsonic Lifting-Surface Theory, Discussion and Editor's Comments," in Analytical Methods in Aircraft Aerodynamics, NASA SP-228, Oct. 1969, pp. 24-35.
20. Silverstein, A. and S. Katzoff, "Design Charts for Predicting Downwash Angles and Wake Characteristics Behind Plain and Flapped Wings," NACA Report No. 648, 1939.
21. Schrenk, O., "A Simple Approximation Method for Obtaining the Spanwise Lift Distribution," NACA Technical Memorandum No. 948, 1940.
22. "Civil Aeronautics Manual 04," Revised 1 July 1944, U. S. Department of Commerce.
23. Hall, Charles F., "Lift Drag, and Pitching Moment of Low-Aspect-Ratio Wings at Subsonic and Supersonic Speeds," NACA RM A53A30, April 1953.
24. Anderson, Adrien E., "Chordwise and Spanwise Loadings Measured at Low Speed on Large Triangular Wings," NACA RM No. A9B17, April 1949.
25. Etkin, B., Dynamics of Flight, Stability and Control, John Wiley & Sons, Inc., New York, 1959 Edition, Appendix B.
26. Wetmore, J. W. and L. I. Turner, Jr., "Determination of Ground Effect from Tests of a Glider in Towed Flight," NACA Report No. 695.
27. Carter, W. A., "Effects of Ground Proximity on the Longitudinal Aerodynamic Characteristics of an Upswept Aspect-Ratio-10 Wing," NASA TN D-5662, Feb. 1970.
28. Fox, Jr., Charles H., "Prediction of Lift and Drag for Slender Sharp-Edge Delta Wings in Ground Proximity," NASA TN D-4891, Jan. 1969.

29. DeYoung, J. and C. W. Harper, "Theoretical Symmetric Span Loading at Subsonic Speeds for Wings Having Arbitrary Planform," NACA Report No. 921, 1948.
30. Campbell, G. S., "A Finite-Step Method for the Calculation of Span Loadings of Unusual Planforms," NACA RM L50L13, July 1951.
31. Riley, D. R., "Wind-Tunnel Investigation and Analysis of the Effects of End Plates on the Aerodynamic Characteristics of an Unswept Wing," NACA TN 2449, 1951.
32. Scallion, W. I. and Cannon, M. D., "The Low-Speed Static Longitudinal and Lateral Characteristics of a Delta-Wing Model with Fixed and Free-Floating Canard Surfaces," Technical Memorandum X-120, July 1959, NASA,
33. Baker, P. A., W. G. Schweikhard, and W. R. Young, "Flight Evaluation of Ground Effect on Several Low-Aspect-Ratio Airplanes," NASA TN D-6053, Oct. 1970.
34. "USAF Stability and Control DATCOM," Flight Control Division, USAF Flight Dynamics Laboratory, Rev. Sept. 1970.
35. Isherwood, J. K., "Generalized Plot Program TRWPLT User's Manual," TRW Systems Rept. 11176-H594-R0-00, Aug. 1970.



## 9.0 SOURCE-PROGRAM LISTING

MAP NSURF, NSURF	NSU	10	1
SEG A01-A02-A03-A04-A05-A06-A07-A08-A09-A10-A11-A12-A13-A14-A15-A16-A17	NSU	20	2
	NSU	30	3
MAP ISURF, ISURF	ISU	10	4
SEG B01-B02-B03-B04-B05-B06-B07-B08-B09-B10-B11-B12-B13-B14-B15-B16-B17-B18-B19	ISU	20	5
	ISU	30	6
MAP NSURFT, NSURFT	NSUT	10	7
SEG A10-A14-A17	NSUT	20	8
MAP ISURFT, ISURFT	ISUT	10	9
SEG B20-B13-B19	ISUT	20	10
FOR A01, A01	A01	10	11
C	A01	20	12
C	A01	30	13
C	A01	40	14
C	A01	50	15
C	A01	60	16
C	A01	70	17
C	A01	80	18
C	A01	90	19
C	A01	100	20
C	A01	110	21
C	A01	120	22
C	A01	130	23
C	A01	140	24
C	A01	150	25
C	A01	160	26
C	A01	170	27
C	A01	180	28
C	A01	190	29
C	A01	200	30
C	A01	210	31
C	A01	220	32
C	A01	230	33
C	A01	240	34
C	A01	250	35
C	A01	260	36
C	A01	270	37
C	A01	280	38
C	A01	290	39
C	A01	300	40
C	A01	310	41
C	A01	320	42
C	A01	330	43
C	A01	340	44
C	A01	350	45
C	A01	360	46
C	A01	370	47
C	A01	380	48
C	A01	390	49
C	A01	400	50
C	A01	410	51
C	A01	420	52
C	A01	430	53
C	A01	440	54
C	A01	450	55
C	A01	460	56
C	A01	470	57
C	A01	480	58
C	A01	490	59
C	A01	500	60
C	A01	510	61
C	A01	520	62
C	A01	530	63
C	A01	540	64
C	A01	550	65
C	A01	560	66
C	A01	570	67
C	A01	580	68
C	A01	590	69
C	A01	600	70
C	A01	610	71
C	A01	620	72
C	A01	630	73
C	A01	640	74
C	A01	650	75
C	A01	660	76
C	A01	670	77
C	A01	680	78
C	A01	690	79
C	A01	700	80
C	A01	710	81
C	A01	720	82
C	A01	730	83
C	A01	740	84
C	A01	750	85
C	A01	760	86
C	A01	770	87
C	A01	780	88
C	A01	790	89
C	A01	800	90
C	A01	810	91

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      WRITE (KOUT,1050)
      WRITE (KJUT,1040)
      LIN=15
1060 READ (KIN,1000) (STORE(I),I=1,14)
      WRITE (KT1,1000) (STORE(I),I=1,14)
      IF (LIN-LIN) 1070,1080,1080
1070 WRITE (KOUT,1020)
      LIN= 3
1080 LIN= LIN +1
      WRITE (KJUT,1030) (STORE(I),I=1,14)
C
      IF (STORE(1).NE.TEST) GO TO 1060
      FNO FILE KT1
      REWIND KT1
      WRITE (KOUT,1040)
C
      NCOMT=-1
      NCALCP= -1
      ISUM = 0.0
      GSCALE= 1.0
C
      CALL RESET
C
C
1090 READ (KT1,1000) (TITLE(I),I=1,14)
      IF (TITLE(1).EQ.TEST) CALL EXIT
      IF (NCOMT) 1100,1100,1110
1100 READ (KT1,1000) (CCMTS(I),I=1,42)
1110 NCOMT= 1
      REAC (KT1,INPUT)
C
      IF (NCALCP) 1120,1120,1140
1120 NCALCP= 1
1130 REWIND KT2
1140 CONTINUE
C
      NSURF= NWING *NFLS +IARS(INVTAI)
      NSYM = NWING * NFUS
      DO 1160 NSF=1,NSLRF
      SYMLF(NSF) = 0.0
      IF (NSYM-NSF) 1150,1160,1160
1150 SYMLF(NSF) = 1.0
1160 CONTINUE
C
C
      ALFAD= 0.0
      ZHO = 10000.0
      CMAK = 0.0
C
      XCG = GSCALE*XCG
      YCG = GSCALE*YCG
      ZCG = GSCALE*ZCG
      REFC= GSCALE*REFC
      REFB= GSCALE*REFB
      REFS= GSCALE*GSCALE*REFS
C
      IF (WSMOTH-1.0) 1180,1180,1170
1170 WSMOTH= WSMOTH*GSCALE
1180 CONTINUE
C
      DO 1240 N=1,5
      IF (WFLAP1(N)-1.0) 1200,1200,1190
1190 WFLAP1(N) = WFLAP1(N)*GSCALE
1200 IF (WFLAP2(N)-1.0) 1220,1220,1210
1210 WFLAP2(N) = WFLAP2(N)*GSCALE
1220 IF (WFLAP3(N)-1.0) 1240,1240,1230
1230 WFLAP3(N) = WFLAP3(N)*GSCALE
1240 CONTINUE
C
      JX= NSS(NSURF)
      DO 1270 K=1,10
      DO 1260 J=1,JX
      IF (IFLG(16)) 1250,1260,1250
1250 ZOC(K,J)= ZOC(K,J)/C(J)
1260 CONTINUE
1270 CONTINUE
C
      DO 1310 J=1,30
      X(J) = X(J)*GSCALE
      Y(J) = Y(J)*GSCALE
      Z(J) = Z(J)*GSCALE
      C(J) = C(J)*GSCALE
      IF (FLAPC(J)-1.0) 1290,1290,1280
1280 FLAPC(J)= FLAPC(J)*GSCALE
1290 IF (TARC(J)-1.0) 1310,1310,1300
1300 TARC(J) = TARC(J)*GSCALE
1310 CONTINUE
C
      GSCALE= 1.0
C
C
      CALL PAGE
      WRITE (KJUT,INPUT)
C
C
      CALL LOFT
C
C
      DO 1420 N=1,NJOB
C
      ALFAD= ALFA(N)
      HEIGHT= HEIGHT(N)
      ALFAD= ALFAD
      ZHO = HEIGHT
      CMAK = 0.0

```

A01	820	92
A01	830	93
A01	840	94
A01	850	95
A01	860	96
A01	870	97
A01	880	98
A01	890	99
A01	900	100
A01	910	101
A01	920	102
A01	930	103
A01	940	104
A01	950	105
A01	960	106
A01	970	107
A01	980	108
A01	990	109
A01	1000	110
A01	1010	111
A01	1020	112
A01	1030	113
A01	1040	114
A01	1050	115
A01	1060	116
A01	1070	117
A01	1080	118
A01	1090	119
A01	1100	120
A01	1110	121
A01	1120	122
A01	1130	123
A01	1140	124
A01	1150	125
A01	1160	126
A01	1170	127
A01	1180	128
A01	1190	129
A01	1200	130
A01	1210	131
A01	1220	132
A01	1230	133
A01	1240	134
A01	1250	135
A01	1260	136
A01	1270	137
A01	1280	138
A01	1290	139
A01	1300	140
A01	1310	141
A01	1320	142
A01	1330	143
A01	1340	144
A01	1350	145
A01	1360	146
A01	1370	147
A01	1380	148
A01	1390	149
A01	1400	150
A01	1410	151
A01	1420	152
A01	1430	153
A01	1440	154
A01	1450	155
A01	1460	156
A01	1470	157
A01	1480	158
A01	1490	159
A01	1500	160
A01	1510	161
A01	1520	162
A01	1530	163
A01	1540	164
A01	1550	165
A01	1560	166
A01	1570	167
A01	1580	168
A01	1590	169
A01	1600	170
A01	1610	171
A01	1620	172
A01	1630	173
A01	1640	174
A01	1650	175
A01	1660	176
A01	1670	177
A01	1680	178
A01	1690	179
A01	1700	180
A01	1710	181
A01	1720	182
A01	1730	183
A01	1740	184
A01	1750	185
A01	1760	186
A01	1770	187
A01	1780	188
A01	1790	189
A01	1800	190
A01	1810	191
A01	1820	192
A01	1830	193
A01	1840	194
A01	1850	195
A01	1860	196
A01	1870	197

EXEC(1)= 1.0	A01 1880	198
IF (MACHN(N)-0.95) 1320,1320,1330	A01 1890	199
1320 CMAK = MACHN(N)	A01 1900	200
C	A01 1910	201
CALL ABORTJ(5,CMAK,N)	A01 1920	202
C	A01 1930	203
EXEC(1)= SQRT(1.0-CMAK**2)	A01 1940	204
1330 CONTINUE	A01 1950	205
C	A01 1960	206
C	A01 1970	207
DO 1390 L=1,6	A01 1980	208
NS1= NSOLV(1,L)	A01 1990	209
NS2= NSOLV(2,L)	A01 2000	210
IF (NS2) 1390,1390,1340	A01 2010	211
1340 CONTINUE	A01 2020	212
C	A01 2030	213
TEST = 0.0	A01 2040	214
DO 1350 M=NS1,NS2	A01 2050	215
SYMLF(M)= 0.0	A01 2060	216
1350 TEST= TEST + ABS( AILDJ(1,M) - AILDJ(2,M) ) -0.01	A01 2070	217
IF (TEST) 1380,1380,1360	A01 2080	218
1360 CONTINUE	A01 2090	219
DO 1370 M=NS1,NS2	A01 2100	220
1370 SYMLF(M)= 1.0	A01 2110	221
1380 CONTINUE	A01 2120	222
C	A01 2130	223
C	A01 2140	224
CALL LIFTX(ALFAD,HEIGT,SYMLF,NS1,NS2)	A01 2150	225
C	A01 2160	226
C	A01 2170	227
1390 CONTINUE	A01 2180	228
C	A01 2190	229
C	A01 2200	230
CALL TIME(IMS)	A01 2210	231
IS= IMS/1000	A01 2220	232
ISJB= IS-ISUM	A01 2230	233
ISUM= IS	A01 2240	234
C	A01 2250	235
LIN= LIN+6	A01 2260	236
IF (LINX-LIN) 1400,1410,1410	A01 2270	237
1400 CALL PAGE	A01 2280	238
1410 WRITE (KOUT,1010115JB,IS,KFILE	A01 2290	239
LIN= LIN + LINX	A01 2300	240
C	A01 2310	241
1420 CONTINUE	A01 2320	242
C	A01 2330	243
GO TO 1090	A01 2340	244
C	A01 2350	245
C	A01 2360	246
END	A01 2370	247
7 FOR A02,A02	A02 10	248
C	A02 20	249
C	A02 30	250
SUBROUTINE BLKDAT	A02 40	251
C	A02 50	252
* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG-72	A02 60	253
* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971	A02 70	254
C	A02 80	255
XX	A02 90	256
C	A02 100	257
COMMON/DATA00/ TITLE(14), ALFAD, ZMO, CMAK	A02 110	258
C	A02 120	259
COMMON/DATA01/ KIN, KOUT, KTL, KT2, KT3, KREC, KFILE, LIN, LINX	A02 130	260
1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LDRAG, COLDCP	A02 140	261
2 ,IFLG(20), EXEC(15)	A02 150	262
C	A02 160	263
COMMON/DATA02/ NWING, NFUS, NVTAIL, NSS(5), NSSQ(5), NCS(5)	A02 170	264
1 ,X(30), Y(30), Z(30), E(30), C(30), XDCR(30), FLAPC(30), TABC(30)	A02 180	265
2 ,WSMOTH, FWE(30), ELE(30), ETE(30), EHE(30), EHEE(30)	A02 190	266
3 ,XOC(10,5), ZOC(10,30)	A02 200	267
C	A02 210	268
COMMON/DATA03/ FLAPDJ(5), TABDJ(5), AILDJ(2,5), DELTF1(5), DELTF2(5)	A02 220	269
1 ,WFF1(5), WFF12(5), WFF21(5), WFF22(5), WFF31(5)	A02 230	270
2 ,WFLAP1(5), WFLAP2(5), WFLAP3(5)	A02 240	271
C	A02 250	272
COMMON/DATA04/ WINGD(5,16), JN1(5), JN2(5), KN2(5), SYMGF(5), NSURF	A02 260	273
1 ,EW(60,10), EV(60,10), EC(60,10), ES(60,10), EG(60,10)	A02 270	274
2 ,EN(60,10,6), EV(60,10,6), VVINDX(60,10,3)	A02 280	275
C	A02 290	276
COMMON/DATA05/ XCG,YCG,ZCG,REFS,REFC,REFB	A02 300	277
C	A02 310	278
XX	A02 320	279
C	A02 330	280
DATA KIN/5/, KOUT/6/, KTL/1/, KT2/8/, KT3/3/, KREC/0/, KFILE/0/	A02 340	281
1,LIN/0/, LINX/56/, RAD/57.2958/, PIE/3.14159/, CUTOF1/0.0001/	A02 350	282
2,CUTOF2/0.0029/, DELALF/1.0/, LFLAP/0/, LDRAG/0/, COLDCP/0.75/	A02 360	283
3,IFLG/10,0,0,0,0, 4,0,0,0,0,0, 5*0, 0,0,1,0,4/, EXEC/15*0,0/	A02 370	284
C	A02 380	285
DATA NWING/1/, NFUS/0/, NVTAIL/0/, NSS/2,4*0/, NSSQ/1,4*0/, NCS/2,4*0/	A02 390	286
1,X/30*0,0/, Y/0,0,1000,0,28*0,0/, Z/30*0,0/, E/30*0,0/, C/100,0,100,0	A02 400	287
2,28*0,0/, XDCR/30*0,25/, FLAPC/30*0,25/, TABC/30*0,125/	A02 410	288
3,WSMOTH/0,10/, XOC/0,0,1,0,48*0,0/, ZOC/300*0,0/	A02 420	289
C	A02 430	290
DATA FLAPDJ/5*0,0/, TABDJ/5*0,0/, AILDJ/10*0,0/	A02 440	291
DATA WFLAP1/5*0,0/, WFLAP2/5*0,60/, WFLAP3/5*1,00/	A02 450	292
C	A02 460	293
DATA XCG/0,0/, YCG/0,0/, ZCG/0,0/, REFS/1000,0/, REFC/100,0/	A02 470	294
1 ,REFB/100,0/	A02 480	295
C	A02 490	296
XX	A02 500	297
C	A02 510	298
RETURN	A02 520	299
C	A02 530	300
XXXXXX		

C	END	A02 540	301
		A02 550	302
V FOR A03,A03		A03 10	303
C		A03 20	304
C	SUBROUTINE LOFT	A03 30	305
C		A03 40	306
C	* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72	A03 50	307
C	* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971	A03 60	308
C		A03 70	309
C	XX	A03 80	310
C		A03 90	311
C	DIMENSION COS1(3),COS2(3),COS3(3)	A03 100	312
C	DIMENSION DUMYF(10)	A03 110	313
C		A03 120	314
C		A03 130	315
C	COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINK	A03 140	316
C	1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LORAG, COLOCP	A03 150	317
C	2 ,IFLG(20), EXECK(15)	A03 160	318
C		A03 170	319
C	COMMON/DATA02/ NWING, NFUS, NVTAIL, NSS(5), NSS0(5), NCS(5)	A03 180	320
C	1 ,X(30), Y(30), Z(30), E(30), C(30), XOCR(30), FLAPC(30),TABC(30)	A03 190	321
C	2 ,WSMOTH, EWE(30), ELE(30), ETE(30), EHE(30), EHEE(30)	A03 200	322
C	3 ,XOC(10,5), ZOC(10,30)	A03 210	323
C	COMMON/DATA22/IMAGF(5),JSINGP(5)	A03 220	324
C		A03 230	325
C	COMMON/DATA03/FLAPDJ(5),TABOJ(5),ALDOJ(2,5),DELTFL(5),DELTFL2(5)	A03 240	326
C	1 ,WFF1(5), WFF2(5), WFF21(5), WFF22(5), WFF31(5)	A03 250	327
C	2 ,WFLAP1(5), WFLAP2(5), WFLAP3(5)	A03 260	328
C		A03 270	329
C	COMMON/DATA04/ WINGD(5,16), JN1(5), JN2(5), KN2(5), SYMGF(5),NSURFA03	A03 280	330
C	1 ,EW(60,10), EY(60,10), EC(60,10), ES(60,10), EG(60,10)	A03 290	331
C	2 ,EN(60,10,6), EV(60,10,6), VVINDX(60,10,3)	A03 300	332
C		A03 310	333
C	COMMON/DATA05/XCG,YCG,ZCG,REFS,REFC,REFB	A03 320	334
C		A03 330	335
C	XX	A03 340	336
C		A03 350	337
C	1000 FORMAT(1X,/,1X)	A03 360	338
C		A03 370	339
C	1010 FORMAT(50X,19HLIFTING SURFACE NO=,12,/,50X,211H*1,/,/,1X,	A03 380	340
C	1 60H SPAN RONT TIP ROOT TIP APEA , A03 390		341
C	2 59H ASPECT MEAN MGC YBAR XBAR ZBAR,/, A03 400		342
C	3 61H CHORD CHORD TWIST TWIST , A03 410		343
C	4 60H RATIO CHORD (MAC) (MGC) (MGC) (MGC),/A03 420		344
C	5/,1X,3F10.3,2F10.4,F10.2,F10.4,5F10.3,/,/,1X,	A03 430	345
C	6 60H FLAP FLAP FLAP FLAP TAB LAIL , A03 440		346
C	7 60H RAIL DIHED. SWEEP NO.SPAN NO.CHORD NO.CHORD,/A03 450		347
C	8 61H SPAN1 SPAN2 SPAN3 DEFLEC DEFLEC DEFLEC,A03 460		348
C	9 60H DEFLEC MGC/4 MGC/4 ELEMENTS DISCONT., A03 470		349
C	*/,1X,9F10.3,17,2110,/,/,34X,	A03 480	350
C	1 56HFUS STA WING STA WL STA AREA CHORD SPAN ,/A03 490		351
C	234X,56H X(IG) Y(IG) Z(IG) S(IG) C(IG) B(IG),/A03 500		352
C	331X,6F10.3,/,/,1X)	A03 510	353
C		A03 520	354
C	1020 FORMAT(1X)	A03 530	355
C		A03 540	356
C	1030 FORMAT(1X,	A03 550	357
C	1 60H WS Y Z X(LE) X(4) X(TE) , A03 560		358
C	2 60H TWIST DIHED(C/4) SWEEP(C/4) C(WING) C(FLAP) C(TAB) , A03 570		359
C	3/,1X)	A03 580	360
C	1040 FORMAT( 1X, 12F10.3 )	A03 590	361
C		A03 600	362
C	1050 FORMAT(21X,50H XA(1)/C XA(2)/C XA(3)/C XA(4)/C XA(5)/C, A03 610		363
C	1 50H XA(6)/C XA(7)/C XA(8)/C XA(9)/C XA(10)/C,/,/,21X, A03 620		364
C	2 10F10.4,/,/,1X, 40H X Y Z A(1)/C Z A(2)/C, A03 630		365
C	3 60H Z A(3)/C Z A(4)/C Z A(5)/C Z A(6)/C Z A(7)/C Z A(8)/C, A03 640		366
C	4 20H Z A(9)/C Z A(10)/C,/,1X )	A03 650	367
C	1060 FORMAT( 1X,12F10.4 )	A03 660	368
C		A03 670	369
C	1070 FORMAT(3X,4HJ K, 40H Y Z WL EW , A03 680		370
C	1,30H DWL DC DS ,/,1X)	A03 690	371
C	1080 FORMAT(1X,213,12(1PE10.3) )	A03 700	372
C		A03 710	373
C	1090 FORMAT(3X,1HJ,2X,1HK,5X,2HXV,8X,2HYV,8X,2HZV,8X,3H1XV,7X,3H1YV,7X, A03 720		374
C	* 3H1ZV,7X,2HXN,8X,2HYN,8X,2HZN,8X,3H1XN,7X,3H1YN,7X,3H1ZN,/,1X) A03 730		375
C	1100 FORMAT( 1X, 213, 12(1PE10.3) )	A03 740	376
C		A03 750	377
C	1110 FORMAT(5X,1HR,9X,2HCP,8X,2HCT,8X,2HER,8X,2HET,8X,1HS,9X,2HAR,8X, A03 760		378
C	* 2HMC,8X,3HMG,6X,4HVMGC,6X,4HVMGC,6X,4HVMGC,/,1X)	A03 770	379
C	1120 FORMAT(1X,12F10.3 )	A03 780	380
C		A03 790	381
C	1130 FORMAT(1X,/,1X,14H(EDF PLOT FILE,13,1H) )	A03 800	382
C		A03 810	383
C	XX	A03 820	384
C		A03 830	385
C		A03 840	386
C		A03 850	387
C	*** INITIALIZE ***	A03 860	388
C		A03 870	389
C	XEROX = 0.0	A03 880	390
C	ZEROX = 0.0	A03 890	391
C	NWING= NWING + NFUS	A03 900	392
C	NSURF= NWING + IABS(NVTAIL)	A03 910	393
C	MFLAG= 100	A03 920	394
C	IF(NVTAIL.LT.0) MFLAG= NWING +1	A03 930	395
C	NFUS = 0	A03 940	396
C		A03 950	397
C	CALL ABORTJ(1,XEROX,NSURF)	A03 960	398
C		A03 970	399
C	SUMW = 0.0	A03 980	400
C		A03 990	401
C	NX= 30	A03 1000	402
C	DD 1190 N=1,NX	A03 1010	403

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      EWE(N)= SUMW
      ELE(N)= X(N) - C(N)*XOCR(N)
      ETE(N)= ELE(N) + C(N)
      CFLAP = FLAPC(N)
      CTAB = TABC(N)
C
      IF (CFLAP-1.0) 1140,1150,1190
1140 CFLAP = CFLAP*C(N)
1150 IF (CTAB-1.0) 1160,1170,1190
1160 CTAB = CTAB*C(N)
1170 CONTINUE
      EME(N) = ETE(N) - CFLAP
      EHEE(N)= ETE(N) - CTAB
      IF (N-NX) 1180,1190,1190
1180 NI= N+1
1190 SUMW = SUMW + SQRT( (Z(N)-Z(NI))**2 + (Y(N)-Y(NI))**2 )
C
      NO = 1
      J1= 0
      DO 1200 N=1,NSURF
      J2= NSS(N)
      CALL ABORTJ(10,J2,J1)
      J1= J2
      NSSO(N)= NO
1200 NO = NSS(N) +1
      J1 = 1
C
      CALL ABORTJ(6,XEROX,NI)
C
C *** N-SURFACE LOOP ***
C
      DO 2060 NSF=1,NSURF
C
      ** CALCULATE WETTED LENGTH **
C
      NREPET= 0
      IF(NSF,GE,MFLAG) NREPET= 1
      NSFM1= NSF - 1
      NSF5 = NSF + 5
      NSF10= NSF + 10
      NSPV = IFLG(NSF)
      NCV = IFLG(NSF5)
      NCDIS= IFLG(NSF10)
      NCVW = NCV - NCDIS
      NSPV1= NSPV + 1
      NCV1 = NCV + 1
      NB = NSS(NSF)
      NO = NSSO(NSF)
      NK = MCS(NSF)
      OCORO = 1.0/FLOAT(NCVW)
      IMAGEF(NSF)= NSPV
      JSINGP(NSF)= 0
C
      CALL ABORTJ(3,XEROX,NCV)
      CALL ABORTJ(7,XEROX,NK)
      CALL ABORTJ(8,XEROX,NSPV)
      CALL ABORTJ(9,XEROX,NCVW)
C
      BOTU =(EWE(NB)-EWE(NO))
C
      DELTF1(NSF) = WSMOTH
      DELTF2(NSF) = WSMOTH
C
      IF (DELTf1(NSF)-1.0) 1210,1220,1220
1210 DELTF1(NSF) = DELTF1(NSF)*BOTU
      DELTF2(NSF) = DELTF2(NSF)*BOTU
1220 CONTINUE
C
      WFF11(NSF) = WFLAP1(NSF)
      WFF21(NSF) = WFLAP2(NSF)
      WFF31(NSF) = WFLAP3(NSF)
C
      IF (WFF11(NSF)-1.0) 1230,1240,1240
1230 WFF11(NSF) = WFF11(NSF)*BOTU
1240 IF (WFF21(NSF)-1.0) 1250,1260,1260
1250 WFF21(NSF) = WFF21(NSF)*BOTU
1260 IF (WFF31(NSF)-1.0) 1270,1280,1280
1270 WFF31(NSF) = WFF31(NSF)*BOTU
1280 CONTINUE
C
      WFF11(NSF) = WFF11(NSF) - DELTF1(NSF)/2.0
      WFF21(NSF) = WFF21(NSF) - DELTF1(NSF)/2.0
      WFF31(NSF) = WFF31(NSF) - DELTF1(NSF)/2.0
C
      WFF12(NSF) = WFF11(NSF) + DELTF1(NSF)
      WFF22(NSF) = WFF21(NSF) + DELTF1(NSF)
C
      ** CALCULATE WING PANELS **
C
      IF (NSF-NWING) 1290,1290,1300
1290 CONTINUE
      SYMF= 2.0
      SPAN = BOTU*2.0
      WINGD(NSF,1)= Y(NB)*2.0
      GO TO 1310
1300 CONTINUE
      SYMF= 1.0
      SPAN= BOTU
      WINGD(NSF,1)= SPAN
1310 CONTINUE
C
      WINGD(NSF,2)= C(N0)
      WINGD(NSF,3)= C(NB)

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A03 1020 404
A03 1030 405
A03 1040 406
A03 1050 407
A03 1060 408
A03 1070 409
A03 1080 410
A03 1090 411
A03 1100 412
A03 1110 413
A03 1120 414
A03 1130 415
A03 1140 416
A03 1150 417
A03 1160 418
A03 1170 419
A03 1180 420
A03 1190 421
A03 1200 422
A03 1210 423
A03 1220 424
A03 1230 425
A03 1240 426
A03 1250 427
A03 1260 428
A03 1270 429
A03 1280 430
A03 1290 431
A03 1300 432
A03 1310 433
A03 1320 434
A03 1330 435
A03 1340 436
A03 1350 437
A03 1360 438
A03 1370 439
A03 1380 440
A03 1390 441
A03 1400 442
A03 1410 443
A03 1420 444
A03 1430 445
A03 1440 446
A03 1450 447
A03 1460 448
A03 1470 449
A03 1480 450
A03 1490 451
A03 1500 452
A03 1510 453
A03 1520 454
A03 1530 455
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A03 1560 458
A03 1570 459
A03 1580 460
A03 1590 461
A03 1600 462
A03 1610 463
A03 1620 464
A03 1630 465
A03 1640 466
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A03 1670 469
A03 1680 470
A03 1690 471
A03 1700 472
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A03 1830 485
A03 1840 486
A03 1850 487
A03 1860 488
A03 1870 489
A03 1880 490
A03 1890 491
A03 1900 492
A03 1910 493
A03 1920 494
A03 1930 495
A03 1940 496
A03 1950 497
A03 1960 498
A03 1970 499
A03 1980 500
A03 1990 501
A03 2000 502
A03 2010 503
A03 2020 504
A03 2030 505
A03 2040 506
A03 2050 507
A03 2060 508
A03 2070 509

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WINGD(INSF,4)= E(ND)	A03 2080	510
WINGD(INSF,5)= E(ND)	A03 2090	511
C	A03 2100	512
DSPAN= SPAN/FLOAT(NSPV)	A03 2110	513
C	A03 2120	514
JN1(INSF) = J1	A03 2130	515
JN2(INSF) = J1 + NSPV - 1	A03 2140	516
KN2(INSF) = NCV	A03 2150	517
J2 = JN2(INSF)	A03 2160	518
J3 = J2 + 1	A03 2170	519
C	A03 2180	520
CALL ABORT(J2,XEROX,J3)	A03 2190	521
C	A03 2200	522
SYMGF(INSF)= SYMF	A03 2210	523
C	A03 2220	524
C	A03 2230	525
C	A03 2240	526
C ** VORTEX LATTICE GEOMETRY **	A03 2250	527
C	A03 2260	528
DO 1390 J=J1,J3	A03 2270	529
C	A03 2280	530
WS= -BOTU*(SYMF-1.0) + DSPAN*FLCAT(J-J1)	A03 2290	531
WAA= ABS(WS)	A03 2300	532
WA = WAA + EWF(ND)	A03 2310	533
C	A03 2320	534
CALL CORDF(WA,YA,XLE,XTF,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)	A03 2330	535
C	A03 2340	536
SIGN=1.0	A03 2350	537
TEST= 0.0001-WAA	A03 2360	538
IF (TEST) 1320,1330,1330	A03 2370	539
1320 SIGN= WS/WAA	A03 2380	540
1330 YB= YA*SIGN	A03 2390	541
IF (NCDIS-1) 1350,1340,1340	A03 2400	542
1340 CW= CW - CF	A03 2410	543
1350 CONTINUE	A03 2420	544
C	A03 2430	545
DO 1360 K=1,NCV	A03 2440	546
C	A03 2450	547
XKM= FLOAT(K-1)	A03 2460	548
C	A03 2470	549
EV(J,K)= WS	A03 2480	550
EC(J,K)= CW*DCORD	A03 2490	551
EW(J,K)= WA	A03 2500	552
C	A03 2510	553
EV(J,K,1)= XLE + CW*DCORD*(0.25+XKM)	A03 2520	554
EV(J,K,2)= YB	A03 2530	555
EV(J,K,3)= ZLE	A03 2540	556
C	A03 2550	557
EN(J,K,1)= XLE + CW*DCORD*(COLOCP + XKM)	A03 2560	558
EN(J,K,2)= YB	A03 2570	559
EN(J,K,3)= ZLE	A03 2580	560
C	A03 2590	561
1360 CONTINUE	A03 2600	562
C	A03 2610	563
IF (NCDIS-1) 1390,1370,1380	A03 2620	564
1370 CONTINUE	A03 2630	565
C	A03 2640	566
K= NCV	A03 2650	567
EC(J,K) = CF	A03 2660	568
EV(J,K,1)= XTE - CF*0.75	A03 2670	569
EN(J,K,1)= XTE - CF*(1.0 - COLOCP)	A03 2680	570
GO TO 1390	A03 2690	571
C	A03 2700	572
1380 CONTINUE	A03 2710	573
K= NCV	A03 2720	574
EC(J,K)= CTAB	A03 2730	575
EV(J,K,1)= XTE - CTAB*0.75	A03 2740	576
EN(J,K,1)= XTE - CTAB*(1.0 - COLOCP)	A03 2750	577
K= K - 1	A03 2760	578
EC(J,K) = CF - CTAB	A03 2770	579
EV(J,K,1)= XTE - CTAB - EC(J,K)*0.75	A03 2780	580
EN(J,K,1)= XTE - CTAB - EC(J,K)*(1.0 - COLOCP)	A03 2790	581
C	A03 2800	582
C	A03 2810	583
1390 CONTINUE	A03 2820	584
C	A03 2830	585
C	A03 2840	586
DO 1410 J=J1,J3	A03 2850	587
C	A03 2860	588
WA= EW(J,1)	A03 2870	589
C	A03 2880	590
CALL CORDF(WA,YA,XLE,XTF,ZLF,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)	A03 2890	591
C	A03 2900	592
DO 1400 K=1,NCV	A03 2910	593
C	A03 2920	594
XF1= EV(J,K,1)	A03 2930	595
ZF1= EV(J,K,3)	A03 2940	596
C	A03 2950	597
CALL CAMBER(INSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)	A03 2960	598
C	A03 2970	599
EV(J,K,3) = ZF1	A03 2980	600
C	A03 2990	601
XF1= FN(J,K,1)	A03 3000	602
ZF1= EN(J,K,3)	A03 3010	603
C	A03 3020	604
CALL CAMBER(INSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)	A03 3030	605
C	A03 3040	606
EN(J,K,3) = ZF1	A03 3050	607
C	A03 3060	608
C	A03 3070	609
1400 CONTINUE	A03 3080	610
1410 CONTINUE	A03 3090	611
C	A03 3100	612
C	A03 3110	613
C	A03 3120	614
DO 1430 J=J1,J2	A03 3130	615

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	J3= J+1	A03 3140	616
C	DO 1420 K=1,NCV	A03 3150	617
C	EY(J,K)= FY(J3,K)-EY(J,K)	A03 3160	618
C	ES(J,K)= 0.5*EY(J,K)*( EC(J,K) +EC(J3,K) )	A03 3170	619
C	EN(J,K,1)= 0.5*( EN(J,K,1) + EN(J3,K,1) )	A03 3180	620
C	EN(J,K,2)= 0.5*( EN(J,K,2) + EN(J3,K,2) )	A03 3190	621
C	EN(J,K,3)= 0.5*( EN(J,K,3) + EN(J3,K,3) )	A03 3200	622
C	1420 CONTINUE	A03 3210	623
C	1430 CONTINUE	A03 3220	624
C		A03 3230	625
C		A03 3240	626
C		A03 3250	627
C		A03 3260	628
C		A03 3270	629
C		A03 3280	630
C	** CALCULATE UNIT VECTORS **	A03 3290	631
C		A03 3300	632
C	DO 1490 J=J1,J2	A03 3310	633
C	J3= J+1	A03 3320	634
C		A03 3330	635
C	DO 1480 K=1,NCV	A03 3340	636
C		A03 3350	637
C	SUM1= 0.0	A03 3360	638
C	SUM2= 0.0	A03 3370	639
C	DO 1440 L=1,3	A03 3380	640
C	M= L +3	A03 3390	641
C	EV(J,K,M)= EV(J3,K,L) - EV(J,K,L)	A03 3400	642
C	EN(J,K,M)= EN(J,K,L) - 0.5*( EV(J3,K,L)+EV(J,K,L) )	A03 3410	643
C	SUM1= SUM1 + EV(J,K,M)**2	A03 3420	644
C	1440 SUM2= SUM2 + EN(J,K,M)**2	A03 3430	645
C		A03 3440	646
C	SUM1 = SQRT(SUM1)	A03 3450	647
C	SUM2 = SQRT(SUM2)	A03 3460	648
C		A03 3470	649
C	DO 1450 L=1,3	A03 3480	650
C	M= L +3	A03 3490	651
C	EV(J,K,M)= EV(J,K,M)/SUM1	A03 3500	652
C	EN(J,K,1)= XTE - CTAB - EC(J,K)*(1.0 - COLOCP)	A03 3510	653
C		A03 3520	654
C		A03 3530	655
C	1390 CONTINUE	A03 3540	656
C		A03 3550	657
C		A03 3560	658
C	DO 1410 J=J1,J3	A03 3570	659
C		A03 3580	660
C	WA= EW(J,1)	A03 3590	661
C		A03 3600	662
C	CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)	A03 3610	663
C		A03 3620	664
C	DO 1400 K=1,NCV	A03 3630	665
C		A03 3640	666
C	XF1= EV(J,K,1)	A03 3650	667
C	ZF1= EV(J,K,3)	A03 3660	668
C		A03 3670	669
C	CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)	A03 3680	670
C		A03 3690	671
C	EV(J,K,3) = ZF1	A03 3700	672
C		A03 3710	673
C	XF1= EN(J,K,1)	A03 3720	674
C	ZF1= EN(J,K,3)	A03 3730	675
C		A03 3740	676
C	CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)	A03 3750	677
C		A03 3760	678
C	EN(J,K,3) = ZF1	A03 3770	679
C		A03 3780	680
C	1400 CONTINUE	A03 3790	681
C	1410 CONTINUE	A03 3800	682
C		A03 3810	683
C		A03 3820	684
C		A03 3830	685
C	DO 1430 J=J1,J2	A03 3840	686
C	J3= J+1	A03 3850	687
C		A03 3860	688
C	DO 1420 K=1,NCV	A03 3870	689
C		A03 3880	690
C	EY(J,K)= EY(J3,K)-EY(J,K)	A03 3890	691
C	ES(J,K)= 0.5*EY(J,K)*( EC(J,K) +EC(J3,K) )	A03 3900	692
C		A03 3910	693
C	EN(J,K,1)= 0.5*( EN(J,K,1) + EN(J3,K,1) )	A03 3920	694
C	EN(J,K,2)= 0.5*( EN(J,K,2) + EN(J3,K,2) )	A03 3930	695
C	EN(J,K,3)= 0.5*( EN(J,K,3) + EN(J3,K,3) )	A03 3940	696
C		A03 3950	697
C	1420 CONTINUE	A03 3960	698
C	1430 CONTINUE	A03 3970	699
C		A03 3980	700
C		A03 3990	701
C	** CALCULATE UNIT VECTORS **	A03 4000	702
C		A03 4010	703
C	DO 1490 J=J1,J2	A03 4020	704
C	J3= J+1	A03 4030	705
C		A03 4040	706
C	DO 1480 K=1,NCV	A03 4050	707
C		A03 4060	708
C	SUM1= 0.0	A03 4070	709
C	SUM2= 0.0	A03 4080	710
C	DO 1440 L=1,3	A03 4090	711
C	M= L +3	A03 4100	712
C	EV(J,K,M)= EV(J3,K,L) - EV(J,K,L)	A03 4110	713
C	EN(J,K,M)= EN(J,K,L) - 0.5*( EV(J3,K,L)+EV(J,K,L) )	A03 4120	714
C	SUM1= SUM1 + EV(J,K,M)**2	A03 4130	715
C	1440 SUM2= SUM2 + EN(J,K,M)**2	A03 4140	716
C		A03 4150	717
C	SUM1 = SQRT(SUM1)	A03 4160	718
C	SUM2 = SQRT(SUM2)	A03 4170	719
C		A03 4180	720
C	DO 1450 L=1,3	A03 4190	721

M= L +3	A03 4200	722
EV(J,K,M)= EV(J,K,M)/SUM1	A03 4210	723
COS1(L)= -EN(J,K,M)/SUM2	A03 4220	724
1450 COS2(L)= -EV(J,K,M)	A03 4230	725
C	A03 4240	726
CALL CROSP(COS1,CCS2,COS3)	A03 4250	727
C	A03 4260	728
SUM2= 0.0	A03 4270	729
DO 1460 L=1,3	A03 4280	730
1460 SUM2= SUM2 + COS3(L)**2	A03 4290	731
C	A03 4300	732
SUM2= SQRT(SUM2)	A03 4310	733
C	A03 4320	734
DO 1470 L=1,3	A03 4330	735
M= L+3	A03 4340	736
1470 EN(J,K,M)= COS3(L)/SUM2	A03 4350	737
C	A03 4360	738
1480 CONTINUE	A03 4370	739
1490 CONTINUE	A03 4380	740
C	A03 4390	741
C	A03 4400	742
C	A03 4410	743
** CALCULATE WING CONSTANTS **	A03 4420	744
C	A03 4430	745
WINGD(NSURF, 1) = B, SPAN	A03 4440	746
WINGD(NSURF, 2) = CR, ROOT CHORD	A03 4450	747
WINGD(NSURF, 3) = CT, TIP CHORD	A03 4460	748
WINGD(NSURF, 4) = ER, GEOMETRIC TWIST AT ROOT STATION	A03 4470	749
WINGD(NSURF, 5) = ET, GEOMETRIC TWIST AT TIP STATION	A03 4480	750
WINGD(NSURF, 6) = S, AREA	A03 4490	751
WINGD(NSURF, 7) = AR, ASPECT RATIO	A03 4500	752
WINGD(NSURF, 8) = CM, MEAN CHORD	A03 4510	753
WINGD(NSURF, 9) = MGC, MEAN GEOMETRIC CHORD	A03 4520	754
WINGD(NSURF,10) = YMGC, SPAN LOCATION OF 1/4 MGC	A03 4530	755
WINGD(NSURF,11) = XMGC, HORIZONTAL MOMENT ARM TO 1/4 MGC	A03 4540	756
WINGD(NSURF,12) = ZMGC, VERTICAL MOMENT ARM TO 1/4 MGC	A03 4550	757
WINGD(NSURF,13) = DIHEDRAL ANGLE OF 1/4 MGC	A03 4560	758
WINGD(NSURF,14) = SWEEP ANGLE OF 1/4 MGC	A03 4570	759
C	A03 4580	760
JX = 100	A03 4590	761
DJX = FLOAT(JX)	A03 4600	762
OSPA= SPAN/DJX	A03 4610	763
ZERO = DSPAN/2.0	A03 4620	764
C	A03 4630	765
SUMA = 0.0	A03 4640	766
SUMY = 0.0	A03 4650	767
SUMC = 0.0	A03 4660	768
SUMX = 0.0	A03 4670	769
SUMY = 0.0	A03 4680	770
SUMZ = 0.0	A03 4690	771
C	A03 4700	772
DO 1530 J=1,JX	A03 4710	773
C	A03 4720	774
WS= -ROTU*(SYMF-1.0) + DSPAN*FLOAT(J-1) + ZERO	A03 4730	775
WA= ABS(WS) + EWF(NO)	A03 4740	776
C	A03 4750	777
CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)	A03 4760	778
C	A03 4770	779
DA= CW*OSPA	A03 4780	780
IF(SYMF-1.0)1520,1520,1500	A03 4790	781
1500 DA= DA/SQRT( 1.0 + TAND**2 )	A03 4800	782
1520 CONTINUE	A03 4810	783
C	A03 4820	784
DAC = DA*CW	A03 4830	785
XF1 = XLE + CW/4.0	A03 4840	786
ZF1 = ZLE	A03 4850	787
C	A03 4860	788
CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)	A03 4870	789
C	A03 4880	790
SUMA = SUMA + DA	A03 4890	791
SUMC = SUMC + DAC	A03 4900	792
SUMX = SUMX + DA*XF1	A03 4910	793
SUMY = SUMY + DA*YA	A03 4920	794
SUMZ = SUMZ + DA*ZF1	A03 4930	795
C	A03 4940	796
1530 CONTINUE	A03 4950	797
C	A03 4960	798
C	A03 4970	799
WINGD(NSF, 6) = SUMA	A03 4980	800
WINGD(NSF, 7) = (WINGD(NSF,1)**2)/WINGD(NSF,6)	A03 4990	801
WINGD(NSF, 8) = WINGD(NSF,6)/WINGD(NSF,1)	A03 5000	802
WINGD(NSF, 9) = SUMC/SUMA	A03 5010	803
WINGD(NSF,10) = SUMY/SUMA	A03 5020	804
WINGD(NSF,11) = SUMX/SUMA	A03 5030	805
WINGD(NSF,12) = SUMZ/SUMA	A03 5040	806
C	A03 5050	807
WA= 0.5*( EWE(NO) + EWE(NB) )	A03 5060	808
C	A03 5070	809
CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)	A03 5080	810
C	A03 5090	811
WINGD(NSF,13) = RAD*ATAN( TAND )	A03 5100	812
WINGD(NSF,14) = RAD*ATAN( TANS )	A03 5110	813
C	A03 5120	814
C	A03 5130	815
C	A03 5140	816
** WING GEOMETRY **	A03 5150	817
C	A03 5160	818
CALL PAGE	A03 5170	819
WRITE (KOUT,1010)NSF,(WINGD(NSF,I),I=1,12),WFLAP1(NSF),WFLAP2(NSF)	A03 5180	820
1,WFLAP3(NSF),FLAPD(NSF),TABD(NSF),(ALLOJ(I,NSF),I=1,2),(WINGD(NSF,30	A03 5190	821
2F,1),I=13,14),NSPV,NCV,NCDIS,XCG,YCG,ZCG,REFS,REFC,REFB	A03 5200	822
C	A03 5210	823
LIN = LIN + 19	A03 5220	824
WRITE (KOUT,1030)	A03 5230	825
LIN= LIN+3	A03 5240	826
C	A03 5250	827



C	OSPAN= SPAN/20.0	A03 9260	828
	DO 1580 J=1,21	A03 9270	829
C	WS= -BOTU*(SYMF-1.0) + OSPAN*FLOAT(J-1)	A03 9280	830
	WAA = ABS(WS)	A03 9290	831
	WA = WAA + EWE(N0)	A03 9300	832
C	CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)	A03 9310	833
		A03 9320	834
		A03 9330	835
C	SIGN = 1.0	A03 9340	836
	TEST= 0.0001 - WAA	A03 9350	837
	IF (TEST) 1540,1550,1550	A03 9360	838
1540	SIGN= WS/WAA	A03 9370	839
1550	YB= YA*SIGN	A03 9380	840
	DIHE = SIGN*RAD*ATAN(TAND)	A03 9390	841
	BETA = SIGN*RAD*ATAN(TANS)	A03 9400	842
	XCO4= XLE + CW/4.0	A03 9410	843
C	IF (LINX-LIN) 1560,1570,1570	A03 9420	844
1560	CALL PAGE	A03 9430	845
	WRITE (KOUT,1030)	A03 9440	846
	LIN = LIN +2	A03 9450	847
1570	WRITE (KOUT,1040)WS,YB,ZLE,XLE,XCO4,XTE,EPS,DIHE,BETA,CW,CF,CTAB	A03 9460	848
	LIN= LIN +1	A03 9470	849
1580	CONTINUE	A03 9480	850
C		A03 9490	851
C		A03 9500	852
C		A03 9510	853
C	** AIRFOIL SECTION **	A03 9520	854
C		A03 9530	855
	WRITE (KOUT,1000)	A03 9540	856
	LIN= LIN +7 +3	A03 9550	857
	IF (LINX-LIN) 1590,1600,1600	A03 9560	858
1590	CALL PAGE	A03 9570	859
	LIN= LIN +7	A03 9580	860
1600	WRITE (KOUT,1050)(XOC(I,NSF),I=1,10)	A03 9590	861
	LIN= LIN +1	A03 9600	862
C		A03 9610	863
	DO 1650 J=N0,NB	A03 9620	864
	IF (LINX-LIN) 1610,1620,1620	A03 9630	865
1610	CALL PAGE	A03 9640	866
	WRITE (KOUT,1050)(XOC(I,NSF),I=1,10)	A03 9650	867
	LIN= LIN +7	A03 9660	868
1620	CONTINUE	A03 9670	869
C		A03 9680	870
	DO 1630 K=1,10	A03 9690	871
1630	DUMYF(K)=0.0	A03 9700	872
	K=0	A03 9710	873
	DO 1640 KN=1,NK	A03 9720	874
	K= K+1	A03 9730	875
1640	DUMYF(K)= ZOC(KN,J)	A03 9740	876
	WRITE (KOUT,1060)(X(J),Y(J),(DUMYF(I),I=1,10)	A03 9750	877
	LIN= LIN +1	A03 9760	878
1650	CONTINUE	A03 9770	879
C		A03 9780	880
C		A03 9790	881
	LIN= LIN +3	A03 9800	882
	IF (LINX-LIN) 1660,1670,1670	A03 9810	883
1660	CALL PAGE	A03 9820	884
	LIN= LIN+3	A03 9830	885
1670	WRITE (KOUT,1000)	A03 9840	886
C		A03 9850	887
C		A03 9860	888
C	*** DEBUG OUTPUT ***	A03 9870	889
C		A03 9880	890
	J16 = JN1(NSF)	A03 9890	891
	J26 = JN2(NSF)	A03 9900	892
1680	J1 = JN1(NSF)	A03 9910	893
	J2 = JN2(NSF)	A03 9920	894
	K2 = KN2(NSF)	A03 9930	895
	IF (IFLG(20)-1) 1880,1690,1690	A03 9940	896
1690	CONTINUE	A03 9950	897
C		A03 9960	898
	J3 = J2 +1	A03 9970	899
C		A03 9980	900
	LIN= LIN +2	A03 9990	901
	IF (LINX-LIN) 1700,1710,1710	A03 6000	902
1700	CALL PAGE	A03 6010	903
	LIN= LIN +2	A03 6020	904
1710	WRITE (KOUT,1070)	A03 6030	905
C		A03 6040	906
	DO 1770 K=1,K2	A03 6050	907
	LIN= LIN +1	A03 6060	908
	DO 1760 J=J1,J2	A03 6070	909
	IF (JSINGP(NSF).EQ.J) GO TO 1760	A03 6080	910
	LIN= LIN +1	A03 6090	911
	IF (LINX-LIN) 1720,1730,1730	A03 6100	912
1720	CALL PAGE	A03 6110	913
	WRITE (KOUT,1070)	A03 6120	914
	LIN= LIN +2 +1	A03 6130	915
1730	JPI= J +1	A03 6140	916
	WA= EWE(N0)	A03 6150	917
	TEST= ABS(EW(J,K)-EW(JPI,K)) -0.001	A03 6160	918
	IF (TEST) 1750,1750,1740	A03 6170	919
1740	WA= 0.5*(EW(J,K) + EW(JPI,K) )	A03 6180	920
1750	WB= WA - EWE(N0)	A03 6190	921
	WRITE (KOUT,1080)J,K,(EN(J,K,1),I=2,3),WB,WA,EYIJ,K,EC(J,K),ES(J,	A03 6200	922
	*K)	A03 6210	923
1760	CONTINUE	A03 6220	924
1770	WRITE (KOUT,1020)	A03 6230	925
C		A03 6240	926
	LIN= LIN + 3	A03 6250	927
	IF (LINX-LIN) 1780,1790,1790	A03 6260	928
1780	CALL PAGE	A03 6270	929
		A03 6280	930
		A03 6290	931
		A03 6300	932
		A03 6310	933

1790	WRITE (KOUT,1000)	A03 6320	934
	LIN= LIN +2	A03 6330	935
	IF (LINX-LIN) 1800,1810,1810	A03 6340	936
1800	CALL PAGE	A03 6350	937
	LIN= LIN +2	A03 6360	938
1810	WRITE (KOUT,1090)	A03 6370	939
C		A03 6380	940
	DO 1850 K=1,K2	A03 6390	941
	LIN= LIN +1	A03 6400	942
	DO 1840 J=J1,J2	A03 6410	943
	IF (JSINGP(NSF).EQ.J) GO TO 1840	A03 6420	944
	LIN= LIN +1	A03 6430	945
	IF (LINX-LIN) 1820,1830,1830	A03 6440	946
1820	CALL PAGE	A03 6450	947
	WRITE (KOUT,1090)	A03 6460	948
	LIN= LIN +2	A03 6470	949
1830	CONTINUE	A03 6480	950
	WRITE (KOUT,1100)J,K,(EV(J,K,I),I=1,5),(EN(J,K,I),I=1,6)	A03 6490	951
1840	CONTINUE	A03 6500	952
1850	WRITE (KOUT,1020)	A03 6510	953
C		A03 6520	954
		A03 6530	955
		A03 6540	956
	LIN= LIN +3	A03 6550	957
	IF (LINX-LIN) 1860,1870,1870	A03 6560	958
1860	CALL PAGE	A03 6570	959
	LIN= LIN +3	A03 6580	960
1870	WRITE (KOUT,1000)	A03 6590	961
C		A03 6600	962
C		A03 6610	963
C		A03 6620	964
C	* WRITE ON CALCOMPLOT TAPE *	A03 6630	965
C		A03 6640	966
1880	IF (IFLG(19)-1) 2020,1890,1890	A03 6650	967
1890	CONTINUE	A03 6660	968
C		A03 6670	969
	KFILE = KFILE +1	A03 6680	970
	KREC = 1	A03 6690	971
	KWORD = 6	A03 6700	972
C		A03 6710	973
	J1 = J16	A03 6720	974
	J2 = J26	A03 6730	975
	J3 = J26 +1	A03 6740	976
	REFL = WINGD(1,1)/2.0	A03 6750	977
	XZER = WINGD(1,11)	A03 6760	978
	YZER = 0.0	A03 6770	979
	ZZER = WINGD(1,12)	A03 6780	980
C		A03 6790	981
C	* RECORD 1 - FILE NSURF *	A03 6800	982
C		A03 6810	983
	DO 1900 J=J1,J3	A03 6820	984
C		A03 6830	985
	WA = EW(J,1)	A03 6840	986
C		A03 6850	987
	CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)	A03 6860	988
C		A03 6870	989
	YLE= EV(J,1,2)	A03 6880	990
	YTE= YLE	A03 6890	991
	ZTE= ZLE	A03 6900	992
	XLC= XLE	A03 6910	993
C		A03 6920	994
	CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLC,CW, XLE,ZLE)	A03 6930	995
C		A03 6940	996
	SHE= YLE	A03 6950	997
	CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND, XLE,YLE,ZLE, COS3)	A03 6960	998
C		A03 6970	999
	CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XTE,ZTE)	A03 6980	1000
C		A03 6990	1001
	SHE= YTE	A03 7000	1002
	XLC= XTE	A03 7010	1003
	CALL FLAPI(NSF,WA,SHE,XLC,CF,CTAB,TAND, XTE,YTE,ZTE, COS3)	A03 7020	1004
C		A03 7030	1005
	CALL ISOMET(XLE,YLE,ZLE, REFL,XZER,YZER,ZZER)	A03 7040	1006
	CALL ISOMET(XTE,YTE,ZTE, REFL,XZER,YZER,ZZER)	A03 7050	1007
C		A03 7060	1008
1900	WRITE (KT2)KREC,KWORD,XLE,YLE,ZLE,XTE,YTE,ZTE	A03 7070	1009
C		A03 7080	1010
C		A03 7090	1011
C	* RECORD 2 - FILE NSURF *	A03 7100	1012
C		A03 7110	1013
	KREC= KREC +1	A03 7120	1014
	KWORD= 3	A03 7130	1015
	ITET= 1	A03 7140	1016
C		A03 7150	1017
	DO 1960 J=J1,J3	A03 7160	1018
C		A03 7170	1019
	WA = EW(J,1)	A03 7180	1020
C		A03 7190	1021
	CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)	A03 7200	1022
C		A03 7210	1023
	ITET = -ITET	A03 7220	1024
	KFW = (ITET + 1)/2	A03 7230	1025
	KFB = (1 - ITET)/2	A03 7240	1026
C		A03 7250	1027
	DO 1950 KX=1,K2	A03 7260	1028
C		A03 7270	1029
	K = KX*KFW + (K2+1-KX)*KFB	A03 7280	1030
	XF1 = EV(J,K,1) - 0.25*EC(J,K)	A03 7290	1031
	YF1 = EV(J,K,2)	A03 7300	1032
	ZF1 = ZLE	A03 7310	1033
C		A03 7320	1034
	XF2 = XF1 + EC(J,K)	A03 7330	1035
	YF2 = YF1	A03 7340	1036
	ZF2 = ZLE	A03 7350	1037
C		A03 7360	1038
	IF (ITET) 1910,1910,1930	A03 7370	1039

1910 CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF2,ZF2)	A03 7380	1040
C SHE= YF2	A03 7390	1041
CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND, XF2,YF2,ZF2, COS3)	A03 7400	1042
C	A03 7410	1043
CALL ISOMET(XF2,YF2,ZF2, REFL,XZER,YZER,ZZER)	A03 7420	1044
C	A03 7430	1045
WRITE (KT2)KREC,KWORD,XF2,YF2,ZF2	A03 7440	1046
C	A03 7450	1047
IF (K2-KX) 1920,1920,1950	A03 7460	1048
1920 CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)	A03 7470	1049
C	A03 7480	1050
SHE= YF1	A03 7490	1051
CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND, XF1,YF1,ZF1, COS3)	A03 7500	1052
C	A03 7510	1053
CALL ISOMET(XF1,YF1,ZF1, REFL,XZER,YZER,ZZER)	A03 7520	1054
C	A03 7530	1055
WRITE (KT2)KREC,KWORD,XF1,YF1,ZF1	A03 7540	1056
GO TO 1950	A03 7550	1057
C	A03 7560	1058
1930 CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)	A03 7570	1059
C	A03 7580	1060
SHE= YF1	A03 7590	1061
CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND, XF1,YF1,ZF1, COS3)	A03 7600	1062
C	A03 7610	1063
CALL ISOMET(XF1,YF1,ZF1, REFL,XZER,YZER,ZZER)	A03 7620	1064
C	A03 7630	1065
WRITE (KT2)KREC,KWORD,XF1,YF1,ZF1	A03 7640	1066
C	A03 7650	1067
IF (K2-KX) 1940,1940,1950	A03 7660	1068
1940 CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF2,ZF2)	A03 7670	1069
C	A03 7680	1070
SHE= YF2	A03 7690	1071
CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND, XF2,YF2,ZF2, COS3)	A03 7700	1072
C	A03 7710	1073
CALL ISOMET(XF2,YF2,ZF2, REFL,XZER,YZER,ZZER)	A03 7720	1074
C	A03 7730	1075
WRITE (KT2)KREC,KWORD,XF2,YF2,ZF2	A03 7740	1076
C	A03 7750	1077
1950 CONTINUE	A03 7760	1078
1960 CONTINUE	A03 7770	1079
C	A03 7780	1080
C	A03 7790	1081
* RECORD 3 - FILE NSURF *	A03 7800	1082
C	A03 7810	1083
KREC= KREC +1	A03 7820	1084
KWORD= 3	A03 7830	1085
ITET = -1	A03 7840	1086
C	A03 7850	1087
DO 2010 K=2,K2	A03 7860	1088
C	A03 7870	1089
DO 2000 J=J1,J3	A03 7880	1090
C	A03 7890	1091
IF (ITET) 1970,1970,1980	A03 7900	1092
1970 JR= J	A03 7910	1093
GO TO 1990	A03 7920	1094
1980 JR= J1+J3 -J	A03 7930	1095
1990 CONTINUE	A03 7940	1096
C	A03 7950	1097
WA = EW(JR,K)	A03 7960	1098
C	A03 7970	1099
CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)	A03 7980	1100
C	A03 7990	1101
XF1 = EV(JR,K,1) - 0.25*EC(JR,K)	A03 8000	1102
YF1 = EV(JR,K,2)	A03 8010	1103
ZF1 = ZLE	A03 8020	1104
C	A03 8030	1105
CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)	A03 8040	1106
C	A03 8050	1107
SHE = YF1	A03 8060	1108
CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND, XF1,YF1,ZF1, COS3)	A03 8070	1109
C	A03 8080	1110
CALL ISOMET(XF1,YF1,ZF1, REFL,XZER,YZER,ZZER)	A03 8090	1111
C	A03 8100	1112
2000 WRITE (KT2)KREC,KWORD,XF1,YF1,ZF1	A03 8110	1113
C	A03 8120	1114
ITET= -ITET	A03 8130	1115
C	A03 8140	1116
2010 CONTINUE	A03 8150	1117
C	A03 8160	1118
C	A03 8170	1119
C	A03 8180	1120
END FILE KT2	A03 8190	1121
LIN= LIN +2	A03 8200	1122
WRITE (KOUT,1130)KFILE	A03 8210	1123
C	A03 8220	1124
C	A03 8230	1125
2020 CONTINUE	A03 8240	1126
C	A03 8250	1127
C	A03 8260	1128
C	A03 8270	1129
*** COMPUTE IMAGE VERTICAL SURFACES ***	A03 8280	1130
C	A03 8290	1131
IF (NREPET.EQ.0) GO TO 2060	A03 8300	1132
NREPET= 0	A03 8310	1133
IMAGE(NSF)= 2*IMAGE(NSF)	A03 8320	1134
J1 = JN1(NSF)	A03 8330	1135
J2 = JN2(NSF)	A03 8340	1136
J3 = J2 +1	A03 8350	1137
J1= J3	A03 8360	1138
JSINGP(NSF)= J3	A03 8370	1139
SYMGP(NSF) = 2.0	A03 8380	1140
WINGD(NSF,6) = WINGD(NSF,6)*2.0	A03 8390	1141
WINGD(NSF,10)= 0.0	A03 8400	1142
DO 2050 J=J1,J3	A03 8410	1143
J1= J1 +1	A03 8420	1144
DO 2040 K=1,K2	A03 8430	1145



C		A04	830	1249
C	* INITIALIZE *	A04	840	1250
C	ALFAR = ALFA/RAD	A04	850	1251
	TANA = TAN(ALFAR)	A04	860	1252
	COSA = 1.0/SQRT(1.0+TANA**2)	A04	870	1253
	SINA = TANA*COSA	A04	880	1254
	TANV = -TAN(0.5*ALFAR)	A04	890	1255
	TANVG = -TAN(1.5*ALFAR)	A04	900	1256
	UNIT = 0.25/PIE	A04	910	1257
	UNITG = -UNIT	A04	920	1258
C		A04	930	1259
C		A04	940	1260
	DO 1160 NSF=NSURF1,NSURF2	A04	950	1261
		A04	960	1262
C		A04	970	1263
	NZERO = JN1(NSF)	A04	980	1264
	TEST = SYMLF(NSF)	A04	990	1265
	IF (TEST) 1150,1150,1160	A04	1000	1266
1150	NZERO = IMAGEF(NSF)/2 + NZERO	A04	1010	1267
	IF(JSINGP(NSF).NE.0) NZERO = NZERO +1	A04	1020	1268
1160	JN0(NSF) = NZERO	A04	1030	1269
C		A04	1040	1270
C		A04	1050	1271
C	* CALCULATE MATRICES VMAT(NV) & AMAT(NV, NV) *	A04	1060	1272
C		A04	1070	1273
	NV = 0	A04	1080	1274
C		A04	1090	1275
C		A04	1100	1276
	DO 1520 NSF=NSURF1,NSURF2	A04	1110	1277
		A04	1120	1278
C		A04	1130	1279
	K = NSF + 5	A04	1140	1280
	J1 = JN1(NSF)	A04	1150	1281
	J2 = JN2(NSF)	A04	1160	1282
	K2 = KN2(NSF)	A04	1170	1283
	NZERO = JN0(NSF)	A04	1180	1284
	NSPV = IMAGEF(NSF)	A04	1190	1285
	NCV = IFLG(K)	A04	1200	1286
	NM = 0	A04	1210	1287
	N00 = NSS0(NSF)	A04	1220	1288
C		A04	1230	1289
C		A04	1240	1290
C		A04	1250	1291
	DO 1480 KV=1,K2	A04	1260	1292
	DO 1450 JV=NZERO,J2	A04	1270	1293
	IF (JSINGP(NSF).EQ.JV) GO TO 1450	A04	1280	1294
	NV = NV+1	A04	1290	1295
C		A04	1300	1296
	SYMGF2 = SYMGF(NSF)-1.0	A04	1310	1297
	SYMGF3 = -SYMGF(NSF)+2.0	A04	1320	1298
C		A04	1330	1299
	COS1(1) = COSA	A04	1340	1300
	COS1(2) = 0.0	A04	1350	1301
	COS1(3) = -SINA	A04	1360	1302
C		A04	1370	1303
	DO 1170 L=1,3	A04	1380	1304
	LP3 = L + 3	A04	1390	1305
	COS2(L) = EN(JV,KV,LP3)	A04	1400	1306
1170	P(L) = EN(JV,KV,L)	A04	1410	1307
C		A04	1420	1308
	JP1 = JV + 1	A04	1430	1309
	WA = EWE(N00)	A04	1440	1310
	TEST = ABS( EW(JV,KV) - EW(JP1,KV) ) - 0.001	A04	1450	1311
	IF (TEST) 1190,1190,1180	A04	1460	1312
1180	WA = (EW(JV,KV) + EW(JP1,KV) )/2.0	A04	1470	1313
1190	CONTINUE	A04	1480	1314
	SHE = EN(JV,KV,2)	A04	1490	1315
C		A04	1500	1316
	CALL CORDF(WA, YA, XLE, XTE, ZLE, EPS, CM, CF, CTAB, TAND, TANS, RATS, M1, M2)	A04	1510	1317
	CALL FLAPS(NSF, WA, SHE, XTE, CF, CTAB, TAND, P, COS2)	A04	1520	1318
	CALL DOTP(COS1, COS2, VMATOP)	A04	1530	1319
C		A04	1540	1320
C		A04	1550	1321
	VMAT(NV) = VMATOP	A04	1560	1322
C		A04	1570	1323
C		A04	1580	1324
	DO 1200 L=1,3	A04	1590	1325
1200	COS1(L) = COS2(L)	A04	1600	1326
C		A04	1610	1327
C		A04	1620	1328
C		A04	1630	1329
	NG = 0	A04	1640	1330
	DO 1440 NSR=NSURF1,NSURF2	A04	1650	1331
		A04	1660	1332
C		A04	1670	1333
	J0 = JN0(NSR)	A04	1680	1334
	J3 = JN1(NSR)	A04	1690	1335
	J4 = JN2(NSR)	A04	1700	1336
	K4 = KN2(NSR)	A04	1710	1337
C		A04	1720	1338
	SYMGF2 = SYMGF(NSR) - 1.0	A04	1730	1339
	SYMGF3 = -SYMGF(NSR) + 2.0	A04	1740	1340
	SYMLDG = SYMLF(NSR)	A04	1750	1341
C		A04	1760	1342
	DO 1430 KG=1,K4	A04	1770	1343
C		A04	1780	1344
C		A04	1790	1345
C		A04	1800	1346
	DO 1520 NSF=NSURF1,NSURF2	A04	1810	1347
		A04	1820	1348
C		A04	1830	1349
	K = NSF + 5	A04	1840	1350
	J1 = JN1(NSF)	A04	1850	1351
	J2 = JN2(NSF)	A04	1860	1352
	K2 = KN2(NSF)	A04	1870	1353
	NZERO = JN0(NSF)	A04	1880	1354
	NSPV = IMAGEF(NSF)			

NCV = IFLG(K)	A04 1890	1355
NM = 0	A04 1900	1356
N00= NSSO(NSF)	A04 1910	1357
C	A04 1920	1358
C	A04 1930	1359
C	A04 1940	1360
DO 1480 KV=1,K2	A04 1950	1361
DO 1450 JV=NZERO,J2	A04 1960	1362
IF (JSINGP(NSF),EQ,JV) GO TO 1450	A04 1970	1363
NV= NV+1	A04 1980	1364
C	A04 1990	1365
SYMGE2= SYMGF(NSF)-1.0	A04 2000	1366
SYMGE3=-SYMGE(NSF)+2.0	A04 2010	1367
C	A04 2020	1368
COS1(1)= COSA	A04 2030	1369
COS1(2)= 0.0	A04 2040	1370
COS1(3)= -SINA	A04 2050	1371
C	A04 2060	1372
DO 1170 L=1,3	A04 2070	1373
LP3= L +3	A04 2080	1374
COS2(L)= EN(JV,KV,LP3)	A04 2090	1375
1170 P(L)= EN(JV,KV,L)	A04 2100	1376
C	A04 2110	1377
JP1= JV +1	A04 2120	1378
WA = EWE(ND0)	A04 2130	1379
TEST= ABS( EW(JV,KV) - EW(JP1,KV) ) - 0.001	A04 2140	1380
IF (TEST) 1190,1190,1180	A04 2150	1381
1180 WA = (EW(JV,KV) + EW(JP1,KV) )/2.0	A04 2160	1382
1190 CONTINUE	A04 2170	1383
SHE = EN(JV,KV,2)	A04 2180	1384
C	A04 2190	1385
CALL CORDF(WA,YA,XLF,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)	A04 2200	1386
CALL FLAPS(NSF,WA,SHE,XTE,CF,CTAB,TAND, P,COS2)	A04 2210	1387
CALL DOTPICOS1,COS2,VMATDP)	A04 2220	1388
C	A04 2230	1389
C	A04 2240	1390
VMAT(NV)= VMATDP	A04 2250	1391
C	A04 2260	1392
C	A04 2270	1393
DO 1200 L=1,3	A04 2280	1394
1200 COS1(L)= COS2(L)	A04 2290	1395
C	A04 2300	1396
C	A04 2310	1397
C	A04 2320	1398
NG= 0	A04 2330	1399
DO 1440 NSR=NSURF1,NSURF2	A04 2340	1400
C	A04 2350	1401
J0 = JNO(NSR)	A04 2360	1402
J3 = JN1(NSR)	A04 2370	1403
J4 = JN2(NSR)	A04 2380	1404
K4 = KN2(NSR)	A04 2390	1405
C	A04 2400	1406
SYMGE2 = SYMGF(NSR) - 1.0	A04 2410	1407
SYMGE3 =-SYMGE(NSR) + 2.0	A04 2420	1408
SYMLDG = SYMLF(NSR)	A04 2430	1409
C	A04 2440	1410
DO 1430 KG=1,K4	A04 2450	1411
DO 1420 JG=J0,J4	A04 2460	1412
IF (JSINGP(NSR),EQ,JG) GO TO 1420	A04 2470	1413
NG= NG+1	A04 2480	1414
C	A04 2490	1415
JP1 = JG+1	A04 2500	1416
WA = EW(JG,KG)	A04 2510	1417
C	A04 2520	1418
DO 1210 L=1,3	A04 2530	1419
LP3= L+3	A04 2540	1420
B(L)= EV(JG,KG,L)	A04 2550	1421
1210 D(L)= EV(JP1,KG,L)	A04 2560	1422
C	A04 2570	1423
SHE = B(2)	A04 2580	1424
C	A04 2590	1425
CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)	A04 2600	1426
CALL FLAPS(NSR,WA,SHE,XTE,CF,CTAB,TAND, R,COS3)	A04 2610	1427
C	A04 2620	1428
WA = EW(JP1,KG)	A04 2630	1429
SHE = D(2)	A04 2640	1430
C	A04 2650	1431
CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)	A04 2660	1432
CALL FLAPS(NSR,WA,SHE,XTE,CF,CTAB,TAND, D,COS3)	A04 2670	1433
C	A04 2680	1434
DO 1220 L=1,3	A04 2690	1435
PW(L) = P(L)	A04 2700	1436
BW(L) = B(L)	A04 2710	1437
1220 DW(L) = D(L)	A04 2720	1438
C	A04 2730	1439
CALL VORTEX(P,B,D,TANV,UNIT, V1,COS2)	A04 2740	1440
CALL DOTPICOS1,CCS2,SUM1)	A04 2750	1441
C	A04 2760	1442
SUM1= SUM1*V1	A04 2770	1443
SUM2 = 0.0	A04 2780	1444
C	A04 2790	1445
IF (IFLG(17)-1) 1240,1230,1230	A04 2800	1446
1230 CONTINUE	A04 2810	1447
C	A04 2820	1448
CALL REFLEC(R,ZHEIGT,ALFAR,COSA)	A04 2830	1449
CALL REFLEC(D,ZHEIGT,ALFAR,COSA)	A04 2840	1450
C	A04 2850	1451
CALL VORTEX(P,B,D,TANVG,UNITG, V1,COS2)	A04 2860	1452
CALL DOTPICOS1,CCS2,SUM3)	A04 2870	1453
C	A04 2880	1454
SUM1= SUM1 + SUM3*V1	A04 2890	1455
C	A04 2900	1456
1240 CONTINUE	A04 2910	1457
C	A04 2920	1458
ITEST= J3 -J0	A04 2930	1459
IF (ITEST) 1250,1200,1300	A04 2940	1460

1250	JH = J3 + J4 - JG	A04 2950	1461
	IF (JSINGP(NSR),NE,0) JH= JG-J0+J3	A04 2960	1462
	IF (JH-JG) 1260,1300,1300	A04 2970	1463
1260	CONTINUE	A04 2980	1464
C		A04 2990	1465
	JP1 = JH +1	A04 3000	1466
	WA = EW(JH,KG)	A04 3010	1467
C		A04 3020	1468
	DO 1270 L=1,3	A04 3030	1469
	LP3= L +3	A04 3040	1470
	B(L)= EV(JH,KG,L)	A04 3050	1471
1270	D(L)= EV(JP1,KG,L)	A04 3060	1472
C		A04 3070	1473
	SHE = B(2)	A04 3080	1474
C		A04 3090	1475
	CALL CORDF(WA, YA, XLE, XTE, ZLE, EPS, CW, CF, CTAB, TAND, TANS, RATS, M1, M2)	A04 3100	1476
	CALL FLAPS(NSR, WA, SHE, XTE, CF, CTAB, TAND, B, COS3)	A04 3110	1477
C		A04 3120	1478
	WA = EW(JP1,KG)	A04 3130	1479
	SHE = D(2)	A04 3140	1480
C		A04 3150	1481
	CALL CORDF(WA, YA, XLE, XTE, ZLE, EPS, CW, CF, CTAB, TAND, TANS, RATS, M1, M2)	A04 3160	1482
	CALL FLAPS(NSR, WA, SHE, XTE, CF, CTAB, TAND, D, COS3)	A04 3170	1483
C		A04 3180	1484
	IF (JSINGP(NSR),LE,JH,OR,JO,LE,J3)	A04 3190	1485
	* CALL VORTEX( P,B,D, TANV,UNIT, VI,COS2 )	A04 3200	1486
	IF (JSINGP(NSR),GT,JH,AND,JO,GT,J3)	A04 3210	1487
	* CALL VORTEX( P,D,B, TANV,UNIT, VI,COS2 )	A04 3220	1488
	CALL DOTP(COS1,COS2,SUM2)	A04 3230	1489
C		A04 3240	1490
	SUM2= SUM2*VI	A04 3250	1491
C		A04 3260	1492
	IF (IFLG(17)-1) 1290,1280,1280	A04 3270	1493
1280	CONTINUE	A04 3280	1494
C		A04 3290	1495
	CALL REFLEC(B,ZHEIGT,ALFAR,COSA)	A04 3300	1496
	CALL REFLEC(D,ZHEIGT,ALFAR,COSA)	A04 3310	1497
C		A04 3320	1498
	IF (JSINGP(NSR),LE,JH,OR,JO,LE,J3)	A04 3330	1499
	* CALL VORTEX( P,B,D, TANV,UNIT, VI,COS2 )	A04 3340	1500
	IF (JSINGP(NSR),GT,JH,AND,JO,GT,J3)	A04 3350	1501
	* CALL VORTEX( P,D,B, TANV,UNIT, VI,COS2 )	A04 3360	1502
	CALL DOTP(COS1,COS2,SUM4)	A04 3370	1503
C		A04 3380	1504
	SUM2= SUM2 + SUM4*VI	A04 3390	1505
C		A04 3400	1506
1290	CONTINUE	A04 3410	1507
C		A04 3420	1508
1300	CONTINUE	A04 3430	1509
C		A04 3440	1510
	AMATING,NV) = SUM1 + SUM2	A04 3450	1511
C		A04 3460	1512
	IF (EXECK(15)-1.0) 1310,1410,1410	A04 3470	1513
1310	IF (IFLG(20)-5) 1410,1320,1320	A04 3480	1514
1320	IF (NM-1) 1330,1330,1390	A04 3490	1515
1330	LIN= LIN +4	A04 3500	1516
	NM= 10	A04 3510	1517
	IF (LINX-LIN) 1340,1350,1350	A04 3520	1518
1340	CALL PAGE	A04 3530	1519
	LIN= LIN +4	A04 3540	1520
1350	WRITE (KOUT,1020)NSF,NSURF1,NSURF2	A04 3550	1521
1360	LIN= LIN +2	A04 3560	1522
	IF (LINX-LIN) 1370,1380,1380	A04 3570	1523
1370	CALL PAGE	A04 3580	1524
	LIN= LIN +2	A04 3590	1525
1380	WRITE (KOUT,1030)	A04 3600	1526
1390	LIN= LIN +1	A04 3610	1527
	IF (LINK-LIN) 1370,1400,1400	A04 3620	1528
1400	WRITE (KOUT,1040)JV,KV,NV,NG,VMAT(NV),AMATING,NV),(PW(1),1=1,3),(BA	A04 3630	1529
	1W(1),1=1,3),(DM(1),1=1,3)	A04 3640	1530
1410	CONTINUE	A04 3650	1531
C		A04 3660	1532
		A04 3670	1533
C		A04 3680	1534
		A04 3690	1535
1420	CONTINUE	A04 3700	1536
1430	CONTINUE	A04 3710	1537
1440	CONTINUE	A04 3720	1538
C		A04 3730	1539
	CALL ABORTJ(4,SUM1,NG)	A04 3740	1540
C		A04 3750	1541
		A04 3760	1542
C		A04 3770	1543
1450	CONTINUE	A04 3780	1544
C		A04 3790	1545
	IF (EXECK(15)-1.0) 1460,1480,1480	A04 3800	1546
1460	IF (IFLG(20)-5) 1480,1470,1470	A04 3810	1547
1470	WRITE (KOUT,1000)	A04 3820	1548
	LIN= LIN +1	A04 3830	1549
1480	CONTINUE	A04 3840	1550
C		A04 3850	1551
		A04 3860	1552
C		A04 3870	1553
	LIN= LIN +3	A04 3880	1554
	IF (LINK-LIN) 1490,1500,1500	A04 3890	1555
1490	CALL PAGE	A04 3900	1556
	GO TO 1510	A04 3910	1557
1500	WRITE (KOUT,1010)	A04 3920	1558
1510	CONTINUE	A04 3930	1559
C		A04 3940	1560
1520	CONTINUE	A04 3950	1561
C		A04 3960	1562
		A04 3970	1563
C		A04 3980	1564
	* SOLVE FOR GAMA *	A04 3990	1565
C		A04 4000	1566

NM= 0	A04 4010	1567
SUP= 0.0	A04 4020	1568
DO 1540 J=1,NV	A04 4030	1569
DO 1530 K=1,NG	A04 4040	1570
NM= NM+1	A04 4050	1571
1530 SUP= SUP + DABS( AMAT(K,J) )	A04 4060	1572
1540 CONTINUE	A04 4070	1573
C	A04 4080	1574
SCALE = FLOAT(NM)	A04 4090	1575
SCALE = SUP/SCALE	A04 4100	1576
C	A04 4110	1577
DO 1560 J=1,NV	A04 4120	1578
DO 1550 K=1,NG	A04 4130	1579
1550 AMAT(J,K)= AMAT(J,K)/SCALE	A04 4140	1580
1560 CONTINUE	A04 4150	1581
C	A04 4160	1582
C	A04 4170	1583
CALL DMATIN(AMAT,NV,DETERM)	A04 4180	1584
C	A04 4190	1585
C	A04 4200	1586
NG= 0	A04 4210	1587
DO 1640 NSR=NSURF1,NSURF2	A04 4220	1588
C	A04 4230	1589
J0 = JND(NSR)	A04 4240	1590
J3 = JN1(NSR)	A04 4250	1591
J4 = JN2(NSR)	A04 4260	1592
K4 = KN2(NSR)	A04 4270	1593
C	A04 4280	1594
DO 1630 K=1,K4	A04 4290	1595
DO 1620 J=J0,J4	A04 4300	1596
IF (JSINGP(NSR).EQ.J) GO TO 1620	A04 4310	1597
NG=NG+1	A04 4320	1598
C	A04 4330	1599
SUP= 0.0	A04 4340	1600
NV= 0	A04 4350	1601
DO 1590 NSF=NSURF1,NSURF2	A04 4360	1602
C	A04 4370	1603
NZERO= JND(NSF)	A04 4380	1604
J1 = JN1(NSF)	A04 4390	1605
J2 = JN2(NSF)	A04 4400	1606
K2 = KN2(NSF)	A04 4410	1607
C	A04 4420	1608
DO 1580 KV=1,K2	A04 4430	1609
DO 1570 JV=NZERO,J2	A04 4440	1610
IF (JSINGP(NSF).EQ.JV) GO TO 1570	A04 4450	1611
NV=NV+1	A04 4460	1612
SUP = SUP + VMAT(NV)*AMAT(NV,NG)	A04 4470	1613
1570 CONTINUE	A04 4480	1614
1580 CONTINUE	A04 4490	1615
1590 CONTINUE	A04 4500	1616
C	A04 4510	1617
SUP = SUP/SCALE	A04 4520	1618
SUM = -SUP	A04 4530	1619
C	A04 4540	1620
EG(J,K)= SUM/FECK(K)	A04 4550	1621
C	A04 4560	1622
ITEST= J3 - J0	A04 4570	1623
IF (ITEST) 1600,1620,1620	A04 4580	1624
1600 JM = J3 + J4 - J	A04 4590	1625
IF (JSINGP(NSR).NE.0) JM= J - J0 +J3	A04 4600	1626
IF (JM-J) 1610,1620,1620	A04 4610	1627
1610 EG(JM,K)= EG(J,K)	A04 4620	1628
1620 CONTINUE	A04 4630	1629
1630 CONTINUE	A04 4640	1630
1640 CONTINUE	A04 4650	1631
C	A04 4660	1632
C	A04 4670	1633
C	A04 4680	1634
C	A04 4690	1635
C * SOLVE FOR INDUCED VELOCITY MATRIX *	A04 4700	1636
C	A04 4710	1637
DO 1800 NSF=NSURF1,NSURF2	A04 4720	1638
C	A04 4730	1639
NZERO= JND(NSF)	A04 4740	1640
J1 = JN1(NSF)	A04 4750	1641
J2 = JN2(NSF)	A04 4760	1642
K2 = KN2(NSF)	A04 4770	1643
C	A04 4780	1644
DO 1790 K=1,K2	A04 4790	1645
DO 1780 J=NZERO,J2	A04 4800	1646
IF (JSINGP(NSF).EQ.J) GO TO 1780	A04 4810	1647
C	A04 4820	1648
JP1= J +1	A04 4830	1649
WA = EW(J,K)	A04 4840	1650
SYMGF2= SYMGF(NSF) -1.0	A04 4850	1651
SYMGF3=-SYMGF(NSF) +2.0	A04 4860	1652
SYMLNG= SYMLF(NSF)	A04 4870	1653
C	A04 4880	1654
DO 1650 L=1,3	A04 4890	1655
LP3= L +3	A04 4900	1656
SUMSL(L)= 0.0	A04 4910	1657
R(L)= EV(J,K,L)	A04 4920	1658
1650 O(L)= EV(JP1, K,L)	A04 4930	1659
C	A04 4940	1660
SHE = R(2)	A04 4950	1661
C	A04 4960	1662
CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)	A04 4970	1663
CALL FLAPS(NSF,WA,SHE,XTE,CF,CTAB,TAND, B,COS 3)	A04 4980	1664
C	A04 4990	1665
WA = EW(JP1,K)	A04 5000	1666
SHE = D(2)	A04 5010	1667
C	A04 5020	1668
CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)	A04 5030	1669
CALL FLAPS(NSF,WA,SHE,XTE,CF,CTAB,TAND, D,COS 3)	A04 5040	1670
C	A04 5050	1671
DO 1660 L=1,3	A04 5060	1672



1660 P(L) = 0.5*( B(L)+D(L) )	A04 5070	1673
C	A04 5080	1674
C	A04 5090	1675
DO 1740 NSR=NSURF1,NSURF2	A04 5100	1676
C	A04 5110	1677
J0 = JN0(NSR)	A04 5120	1678
J3 = JN1(NSR)	A04 5130	1679
J4 = JN2(NSR)	A04 5140	1680
K4 = KN2(NSR)	A04 5150	1681
SYMGF2= SYMGF(NSR) -1.0	A04 5160	1682
SYMGF3= SYMGF(NSR) +2.0	A04 5170	1683
C	A04 5180	1684
DO 1730 KG=1,K4	A04 5190	1685
DO 1720 JG=J3,J4	A04 5200	1686
IF (JSINGP(NSR).EQ.JG) GO TO 1720	A04 5210	1687
C	A04 5220	1688
JP1= JG +1	A04 5230	1689
WA = EW(JG,KG)	A04 5240	1690
C	A04 5250	1691
DO 1670 L=1,3	A04 5260	1692
LP3= L +3	A04 5270	1693
B(L)= EV(JG,KG,L)	A04 5280	1694
1670 D(L)= EV(JP1,KG,L)	A04 5290	1695
C	A04 5300	1696
SHE = B(2)	A04 5310	1697
C	A04 5320	1698
CALL CORDFI(WA, YA, XLE, XTE, ZLE, EPS, CW, CF, CTAB, TAND, TANS, RATS, M1, M2)	A04 5330	1699
CALL FLAPS(NSF, WA, SHE, XTE, CF, CTAB, TAND, B, COS3)	A04 5340	1700
C	A04 5350	1701
WA = EW(JP1,KG)	A04 5360	1702
SHE = D(2)	A04 5370	1703
C	A04 5380	1704
CALL CORDFI(WA, YA, XLE, XTE, ZLE, EPS, CW, CF, CTAB, TAND, TANS, RATS, M1, M2)	A04 5390	1705
CALL FLAPS(NSF, WA, SHE, XTE, CF, CTAB, TAND, D, COS3)	A04 5400	1706
C	A04 5410	1707
C	A04 5420	1708
CALL VORTEX(P, B, D, TANV, UNIT, VI, COS2)	A04 5430	1709
C	A04 5440	1710
DO 1680 L=1,3	A04 5450	1711
1680 SUMSL(L)= SUMSL(L) - EG(JG,KG)*VI*COS2(L)	A04 5460	1712
C	A04 5470	1713
IF (IFLG(17)-1) 1710,1690,1690	A04 5480	1714
1690 CONTINUE	A04 5490	1715
C	A04 5500	1716
CALL REFLEC(8, ZHEIGT, ALFAR, COSA)	A04 5510	1717
CALL REFLEC(10, ZHEIGT, ALFAR, COSA)	A04 5520	1718
C	A04 5530	1719
CALL VORTEX(P, B, D, TANV, UNIT, VI, COS2)	A04 5540	1720
C	A04 5550	1721
DO 1700 L=1,3	A04 5560	1722
1700 SUMSL(L)= SUMSL(L) - EG(JG,KG)*VI*COS2(L)	A04 5570	1723
1710 CONTINUE	A04 5580	1724
C	A04 5590	1725
1720 CONTINUE	A04 5600	1726
1730 CONTINUE	A04 5610	1727
1740 CONTINUE	A04 5620	1728
C	A04 5630	1729
DO 1750 L=1,3	A04 5640	1730
1750 VVINDX(J,K,L)= SUMSL(L)*EXECK(1)	A04 5650	1731
C	A04 5660	1732
ITEST= J1 - NZERC	A04 5670	1733
IF (ITEST) 1760,1780,1780	A04 5680	1734
1760 JH= J1 +J2 -J	A04 5690	1735
IF(JSINGP(NSF).NE.0) JH= J -NZERO +J1	A04 5700	1736
IF (JH-J) 1770,1780,1780	A04 5710	1737
1770 CONTINUE	A04 5720	1738
C	A04 5730	1739
VVINDX(JH,K,1) = VVINDX(J,K,1)	A04 5740	1740
VVINDX(JH,K,2) = VVINDX(J,K,2)	A04 5750	1741
VVINDX(JH,K,3) = VVINDX(J,K,3)	A04 5760	1742
C	A04 5770	1743
1780 CONTINUE	A04 5780	1744
1790 CONTINUE	A04 5790	1745
1800 CONTINUE	A04 5800	1746
C	A04 5810	1747
C	A04 5820	1748
C	A04 5830	1749
C	A04 5840	1750
C ** LIFTING SURFACES AIRLOAD COEFFICIENTS **	A04 5850	1751
C	A04 5860	1752
DO 1830 L=1,3	A04 5870	1753
ZUMLG(L) = 0.0	A04 5880	1754
ZUMPG(L) = 0.0	A04 5890	1755
ZACNG(L) = 0.0	A04 5900	1756
SUMLG(L) = 0.0	A04 5910	1757
SUMPG(L) = 0.0	A04 5920	1758
FACNG(L) = 0.0	A04 5930	1759
DO 1820 M=1,2	A04 5940	1760
DO 1810 N=1,5	A04 5950	1761
ZUML(M,N,L) = 0.0	A04 5960	1762
ZUMR(M,N,L) = 0.0	A04 5970	1763
ZUMP(M,N,L) = 0.0	A04 5980	1764
SUML(M,N,L) = 0.0	A04 5990	1765
SUMR(M,N,L) = 0.0	A04 6000	1766
1810 SUMP(M,N,L) = 0.0	A04 6010	1767
1820 CONTINUE	A04 6020	1768
1830 CONTINUE	A04 6030	1769
C	A04 6040	1770
DO 1840 N=1,NSURF	A04 6050	1771
FACN(N,1) = 2.0/WINGD(N,6)	A04 6060	1772
FACN(N,2) = FACN(N,1)/WINGD(N,9)	A04 6070	1773
1840 FACN(N,3) = FACN(N,1)/WINGD(N,1)	A04 6080	1774
FACNG(1) = 2.0/REFS	A04 6090	1775
FACNG(2) = FACNG(1)/REFC	A04 6100	1776
FACNG(3) = FACNG(1)/REFB	A04 6110	1777
C	A04 6120	1778

C		A04 6130	1779
C		A04 6140	1780
	DD 2110 NSF=NSURF1,NSURF2	A04 6150	1781
C		A04 6160	1782
	NM = 0	A04 6170	1783
	J1 = JN1(NSF)	A04 6180	1784
	J2 = JN2(NSF)	A04 6190	1785
	K2 = KN2(NSF)	A04 6200	1786
	N00 = NSS0(NSF)	A04 6210	1787
C		A04 6220	1788
	SYMGF2 = SYMGF(NSF) -1.0	A04 6230	1789
	SYMGF3 = -SYMGF(NSF) *2.0	A04 6240	1790
C		A04 6250	1791
	DD 2100 J=J1,J2	A04 6260	1792
	IF (JSINGP(NSF).EQ.J) GO TO 2100	A04 6270	1793
C		A04 6280	1794
	JPI= J +1	A04 6290	1795
	W1 = EW(J,1)	A04 6300	1796
	W2 = EW(JPI,1)	A04 6310	1797
	IF(JSINGP(NSF).GT.J.AND.JN0(NSF).GT.J1) W1= W2	A04 6320	1798
	IF(JSINGP(NSF).GT.J.AND.JN0(NSF).GT.J1) W2= EW(J,1)	A04 6330	1799
	WA = EW(N00)	A04 6340	1800
	WB = 2.0*( W1-WA )	A04 6350	1801
	TEST= ABS(W1-W2) -0.1	A04 6360	1802
	IF (TEST) 1860,1860,1850	A04 6370	1803
1850	WA = (W1+W2)/2.0	A04 6380	1804
	WB = ABS( W1-W2 )	A04 6390	1805
1860	CONTINUE	A04 6400	1806
C		A04 6410	1807
	CALL CORDF(W1,Y1,XL1,XT1,ZL1,EP1,CW1,CF1,CB1,TAD1,TAS1,RATS,M1,M2)A04	6420	1808
	CALL CORDF(W2,Y2,XL2,XT2,ZL2,EP2,CW2,CF2,CB2,TAD2,TAS2,RATS,M1,M2)A04	6430	1809
	CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAR,TAND,TASO, RATS,M1,M2)A04	6440	1810
C		A04 6450	1811
	TANLE= (XL2-XL1)/0.0001	A04 6460	1812
	TANDE= (ZL2-ZL1)/0.0001	A04 6470	1813
	FOSLE= ABS(Y2-Y1)/0.0001	A04 6480	1814
	IF(FOSLE.GT.0.0001) TANLE= TANLE/FOSLE	A04 6490	1815
	IF(FOSLE.GT.0.0001) TAND = TAND/FOSLE	A04 6500	1816
	IF(TEST.LT.0.0) TANLE= 0.0	A04 6510	1817
	IF(TEST.LT.0.0) TAND = 0.0	A04 6520	1818
	FOSLE = SQRT(1.0 + TANLE**2)	A04 6530	1819
	XHE = 0.5*( XT1+XT2 -CF1-CF2 )	A04 6540	1820
	XHEE = 0.5*( XT1+XT2 -CB1-CB2 )	A04 6550	1821
	COSD = 1.0/SQRT( 1.0 + TAND**2 )	A04 6560	1822
	SIND= 1.0	A04 6570	1823
	IF(TAND.LT.0) SIND= -1.0	A04 6580	1824
	IF(COSD.GT.0.0001) SIND= TAND*COSD	A04 6590	1825
	CW = 0.5*( CW1+CW2 )	A04 6600	1826
	DD 1870 L=1,4	A04 6610	1827
1870	ZUMSL(L) = 0.0	A04 6620	1828
C		A04 6630	1829
		A04 6640	1830
C	DD 2040 K=1,K2	A04 6650	1831
		A04 6660	1832
	NM= NM +1	A04 6670	1833
C		A04 6680	1834
	COS1(L)= VVINDX(J,K,1) + COSA	A04 6690	1835
	COS1(L)= VVINDX(J,K,2)	A04 6700	1836
	COS1(L)= VVINDX(J,K,3) - SINA	A04 6710	1837
C		A04 6720	1838
	DD 1890 L=1,3	A04 6730	1839
	B(L)= EV(J,K,L)	A04 6740	1840
1880	D(L)= EV(JPI,K,L)	A04 6750	1841
C		A04 6760	1842
	SH1 = B(2)	A04 6770	1843
	SH2 = D(2)	A04 6780	1844
C		A04 6790	1845
	CALL FLAPS(NSF,W1,SH1,XT1,CF1,CB1,TAD1, B,COS3)	A04 6800	1846
	CALL FLAPS(NSF,W2,SH2,XT2,CF2,CB2,TAD2, D,COS3)	A04 6810	1847
C		A04 6820	1848
	SUM8 = 0.0	A04 6830	1849
	DD 1890 L=1,3	A04 6840	1850
	P(L)= 0.5*( B(L) + D(L) )	A04 6850	1851
	COS2(L)= D(L)-B(L)	A04 6860	1852
	IF(JSINGP(NSF).GT.J.AND.JN0(NSF).GT.J1) COS2(L)= -COS2(L)	A04 6870	1853
1890	SUM8 = SUM8 + COS2(L)**2	A04 6880	1854
	SUM8 = SQRT(SUM8)	A04 6890	1855
	DD 1900 L=1,3	A04 6900	1856
1900	COS2(L) = COS2(L)/SUM8	A04 6910	1857
C		A04 6920	1858
		A04 6930	1859
C	CALL CROSP(COS1,COS2,COS3)	A04 6940	1860
C		A04 6950	1861
	SLIFT= EG(J,K)*SUM8	A04 6960	1862
C		A04 6970	1863
		A04 6980	1864
C		A04 6990	1865
	DD 1910 L=1,3	A04 7000	1866
	SUMSL(L)= SLIFT*COS3(L)	A04 7010	1867
	ZUMSL(L) = ZUMSL(L) + SUMSL(L)	A04 7020	1868
	SUMLG(L)= SUMLG(L) + SUMSL(L)	A04 7030	1869
	SUML(1,NSF,L)= SUML(1,NSF,L) + SUMSL(L)	A04 7040	1870
1910	SUML(2,NSF,L)= SUML(1,NSF,L)	A04 7050	1871
C		A04 7060	1872
	X1 = P(1) - WINGD(NSF,11)	A04 7070	1873
	X2 = P(2)	A04 7080	1874
	X3 = P(3) - WINGD(NSF,12)	A04 7090	1875
C		A04 7100	1876
	SUMP(1,NSF,1)= SUMP(1,NSF,1) + ( X1*SUMSL(3) -X3*SUMSL(1) )	A04 7110	1877
	SUMP(1,NSF,2)= SUMP(1,NSF,2) - ( X2*SUMSL(3) -X3*SUMSL(2) )	A04 7120	1878
	SUMP(1,NSF,3)= SUMP(1,NSF,3) - ( X2*SUMSL(1) -X1*SUMSL(2) )	A04 7130	1879
C		A04 7140	1880
	X1 = P(1) - WINGD(1,11)	A04 7150	1881
	X2 = P(2)	A04 7160	1882
	X3 = P(3) - WINGD(1,12)	A04 7170	1883
C		A04 7180	1884
	SUMP(2,NSF,1)= SUMP(2,NSF,1) + ( X1*SUMSL(3) - X3*SUMSL(1) )		

SUMP(2,NSF,2) = SUMP(2,NSF,2) - ( X2*SUMSL(3) - X3*SUMSL(2) )	A04 7190	1885
SUMP(2,NSF,3) = SUMP(2,NSF,3) - ( X2*SUMSL(1) - X1*SUMSL(2) )	A04 7200	1886
C	A04 7210	1887
X1 = P(1) - XCG	A04 7220	1888
X2 = P(2) - YCG	A04 7230	1889
X3 = P(3) - ZCG	A04 7240	1890
C	A04 7250	1891
SUMPG(1) = SUMP(1) + ( X1*SUMSL(3) - X3*SUMSL(1) )	A04 7260	1892
SUMPG(2) = SUMP(2) - ( X2*SUMSL(3) - X3*SUMSL(2) )	A04 7270	1893
SUMPG(3) = SUMP(3) - ( X2*SUMSL(1) - X1*SUMSL(2) )	A04 7280	1894
C	A04 7290	1895
SUMB = 0.0	A04 7300	1896
DD 1920 L=1,3	A04 7310	1897
1920 SUMB = SUMB + SUMSL(L)**2	A04 7320	1898
SUMSL(4) = SQR(T(SUMB))	A04 7330	1899
DD 1930 L=1,3	A04 7340	1900
1930 SUMSL(L) = SUMSL(L)/SUMSL(4)	A04 7350	1901
C	A04 7360	1902
C	A04 7370	1903
C	A04 7380	1904
IF (EXECK(15)-1.C) 1940,2030,2030	A04 7390	1905
1940 IF (IFLG(20)-2) 2030,1950,1950	A04 7400	1906
1950 IF (NM-1) 1960,1960,2010	A04 7410	1907
1960 LIN = LIN + 4	A04 7420	1908
NM = 10	A04 7430	1909
IF (LINK-LIN) 1970,1980,1980	A04 7440	1910
1970 CALL PAGE	A04 7450	1911
LIN = LIN + 4	A04 7460	1912
1980 WRITE (KOUT,1050)NSF,NSURF1,NSURF2	A04 7470	1913
LIN = LIN + 2	A04 7480	1914
IF (LINK-LIN) 1990,2000,2000	A04 7490	1915
1990 CALL PAGE	A04 7500	1916
LIN = LIN + 2	A04 7510	1917
2000 WRITE (KOUT,1060)	A04 7520	1918
2010 LIN = LIN + 1	A04 7530	1919
IF (LINK-LIN) 1950,2020,2020	A04 7540	1920
2020 CPLIFT = -2.0*SLIFT/FS(J,K)	A04 7550	1921
WRITE (KOUT,1070)J,K,(P(1),1,1,3),ES(J,K),CPLIFT,(COS(3)),I=1,3,(	A04 7560	1922
1VVINDX(J,K,I),I=1,3),EG(J,K)	A04 7570	1923
2030 CONTINUE	A04 7580	1924
C	A04 7590	1925
C	A04 7600	1926
2040 CONTINUE	A04 7610	1927
C	A04 7620	1928
P(1) = XLE	A04 7630	1929
P(3) = ZLE	A04 7640	1930
C	A04 7650	1931
SCTS = ZUMSL(1)	A04 7660	1932
IF(SCTS.GT.0.0) SCTS = 0.0	A04 7670	1933
SNFC = ABS(FOFSL*SCTS)	A04 7680	1934
IF(ZUMSL(3).LT.0.0) SNFC = -SNFC	A04 7690	1935
ZUMSL(1) = -SCTS	A04 7700	1936
ZUMSL(2) = SCTS*TANLE	A04 7710	1937
ZUMSL(3) = SNFC	A04 7720	1938
C	A04 7730	1939
X1 = P(1) - WINGD(NSF,1)	A04 7740	1940
X2 = P(2)	A04 7750	1941
X3 = P(3) - WINGD(NSF,2)	A04 7760	1942
C	A04 7770	1943
ZUMP(1,NSF,1) = ZUMP(1,NSF,1) + ( X1*ZUMSL(3) - X3*ZUMSL(1) )	A04 7780	1944
ZUMP(1,NSF,2) = ZUMP(1,NSF,2) - ( X2*ZUMSL(3) - X3*ZUMSL(2) )	A04 7790	1945
ZUMP(1,NSF,3) = ZUMP(1,NSF,3) - ( X2*ZUMSL(1) - X1*ZUMSL(2) )	A04 7800	1946
C	A04 7810	1947
X1 = P(1) - WINGD(1,1)	A04 7820	1948
X2 = P(2)	A04 7830	1949
X3 = P(3) - WINGD(1,2)	A04 7840	1950
C	A04 7850	1951
ZUMP(2,NSF,1) = ZUMP(2,NSF,1) + ( X1*ZUMSL(3) - X3*ZUMSL(1) )	A04 7860	1952
ZUMP(2,NSF,2) = ZUMP(2,NSF,2) - ( X2*ZUMSL(3) - X3*ZUMSL(2) )	A04 7870	1953
ZUMP(2,NSF,3) = ZUMP(2,NSF,3) - ( X2*ZUMSL(1) - X1*ZUMSL(2) )	A04 7880	1954
C	A04 7890	1955
X1 = P(1) - XCG	A04 7900	1956
X2 = P(2) - YCG	A04 7910	1957
X3 = P(3) - ZCG	A04 7920	1958
C	A04 7930	1959
ZUMPG(1) = ZUMPG(1) + ( X1*ZUMSL(3) - X3*ZUMSL(1) )	A04 7940	1960
ZUMPG(2) = ZUMPG(2) - ( X2*ZUMSL(3) - X3*ZUMSL(2) )	A04 7950	1961
ZUMPG(3) = ZUMPG(3) - ( X2*ZUMSL(1) - X1*ZUMSL(2) )	A04 7960	1962
C	A04 7970	1963
DD 2050 L=1,3	A04 7980	1964
ZUMLG(L) = ZUMLG(L) + ZUMSL(L)	A04 7990	1965
ZUML(1,NSF,L) = ZUML(1,NSF,L) + ZUMSL(L)	A04 8000	1966
2050 ZUML(2,NSF,L) = ZUML(1,NSF,L)	A04 8010	1967
C	A04 8020	1968
IF (EXECK(15)-1.C) 2060,2100,2100	A04 8030	1969
2060 IF (IFLG(20)-2) 2100,2070,2070	A04 8040	1970
2070 LIN = LIN + 2	A04 8050	1971
IF (LINK-LIN) 2080,2090,2090	A04 8060	1972
2080 CALL PAGE	A04 8070	1973
GO TO 2100	A04 8080	1974
2090 WRITE (KOUT,1000)	A04 8090	1975
WRITE (KOUT,1000)	A04 8100	1976
2100 CONTINUE	A04 8110	1977
C	A04 8120	1978
C	A04 8130	1979
SUMR(1,NSF,1) = ( SUML(1,NSF,1)*COSA - SUML(1,NSF,3)*SINA )	A04 8140	1980
SUMR(1,NSF,2) = SUML(1,NSF,2)	A04 8150	1981
SUMR(1,NSF,3) = (-SUML(1,NSF,3)*COSA - SUML(1,NSF,1)*SINA )	A04 8160	1982
C	A04 8170	1983
SUMR(2,NSF,1) = SUMR(1,NSF,1)	A04 8180	1984
SUMR(2,NSF,2) = SUMR(1,NSF,2)	A04 8190	1985
SUMR(2,NSF,3) = SUMR(1,NSF,3)	A04 8200	1986
C	A04 8210	1987
SUML(1,NSF,3) = -SUML(1,NSF,3)	A04 8220	1988
SUML(2,NSF,3) = -SUML(1,NSF,3)	A04 8230	1989
C	A04 8240	1990

ZUMR(1,NSF,1) = ( ZUML(1,NSF,1)*COS(A) - ZUML(1,NSF,3)*SIN(A)	A04 8250	1991
ZUMR(1,NSF,2) = ZUML(1,NSF,2)	A04 8260	1992
ZUMR(1,NSF,3) = (-ZUML(1,NSF,3)*COS(A) - ZUML(1,NSF,1)*SIN(A)	A04 8270	1993
C	A04 8280	1994
ZUMR(2,NSF,1) = ZUMR(1,NSF,1)	A04 8290	1995
ZUMR(2,NSF,2) = ZUMR(1,NSF,2)	A04 8300	1996
ZUMR(2,NSF,3) = ZUMR(1,NSF,3)	A04 8310	1997
C	A04 8320	1998
ZUML(1,NSF,3) = -ZUML(1,NSF,3)	A04 8330	1999
ZUML(2,NSF,3) = -ZUML(1,NSF,3)	A04 8340	2000
C	A04 8350	2001
2110 CONTINUE	A04 8360	2002
C	A04 8370	2003
C	A04 8380	2004
C	A04 8390	2005
DO 2130 N=NSURF1,NSURF2	A04 8400	2006
C	A04 8410	2007
DO 2120 L=1,3	A04 8420	2008
ZUML(2,N,L) = ZUML(1,N,L)*FACN(1,1)	A04 8430	2009
ZUMR(2,N,L) = ZUMR(1,N,L)*FACN(1,1)	A04 8440	2010
ZUML(1,N,L) = ZUML(1,N,L)*FACN(N,1)	A04 8450	2011
ZUMR(1,N,L) = ZUMR(1,N,L)*FACN(N,1)	A04 8460	2012
SUML(2,N,L) = SUML(1,N,L)*FACN(1,1)	A04 8470	2013
SUMR(2,N,L) = SUMR(1,N,L)*FACN(1,1)	A04 8480	2014
SUML(1,N,L) = SUML(1,N,L)*FACN(N,1)	A04 8490	2015
2120 SUMR(1,N,L) = SUMR(1,N,L)*FACN(N,1)	A04 8500	2016
C	A04 8510	2017
ZUMP(1,N,1) = ZUMP(1,N,1)*FACN(N,2)	A04 8520	2018
ZUMP(1,N,2) = ZUMP(1,N,2)*FACN(N,3)	A04 8530	2019
ZUMP(1,N,3) = ZUMP(1,N,3)*FACN(N,3)	A04 8540	2020
ZUMP(2,N,1) = ZUMP(2,N,1)*FACN(1,2)	A04 8550	2021
ZUMP(2,N,2) = ZUMP(2,N,2)*FACN(1,3)	A04 8560	2022
ZUMP(2,N,3) = ZUMP(2,N,3)*FACN(1,3)	A04 8570	2023
C	A04 8580	2024
SUMP(1,N,1) = SUMP(1,N,1)*FACN(N,2)	A04 8590	2025
SUMP(1,N,2) = SUMP(1,N,2)*FACN(N,3)	A04 8600	2026
SUMP(1,N,3) = SUMP(1,N,3)*FACN(N,3)	A04 8610	2027
SUMP(2,N,1) = SUMP(2,N,1)*FACN(1,2)	A04 8620	2028
SUMP(2,N,2) = SUMP(2,N,2)*FACN(1,3)	A04 8630	2029
2130 SUMP(2,N,3) = SUMP(2,N,3)*FACN(1,3)	A04 8640	2030
C	A04 8650	2031
C	A04 8660	2032
DO 2150 N=2,NSURF2	A04 8670	2033
DO 2140 L=1,3	A04 8680	2034
ZUML(2,1,L) = ZUML(2,1,L) + ZUML(2,N,L)	A04 8690	2035
ZUMR(2,1,L) = ZUMR(2,1,L) + ZUMR(2,N,L)	A04 8700	2036
ZUMP(2,1,L) = ZUMP(2,1,L) + ZUMP(2,N,L)	A04 8710	2037
SUML(2,1,L) = SUML(2,1,L) + SUML(2,N,L)	A04 8720	2038
SUMR(2,1,L) = SUMR(2,1,L) + SUMR(2,N,L)	A04 8730	2039
2140 SUMP(2,1,L) = SUMP(2,1,L) + SUMP(2,N,L)	A04 8740	2040
2150 CONTINUE	A04 8750	2041
C	A04 8760	2042
ZUML(1,NSF,L) = ZUML(1,NSF,L) + ZUMSL(L)	A04 8770	2043
2050 ZUML(2,NSF,L) = ZUML(1,NSF,L)	A04 8780	2044
C	A04 8790	2045
IF (EXECK(15)-1.C) 2060,2100,2100	A04 8800	2046
2060 IF (IFLG(201)-2) 2100,2070,2070	A04 8810	2047
2070 LIN = LIN + 2	A04 8820	2048
IF (LINX-LIN) 2080,2090,2090	A04 8830	2049
2080 CALL PAGE	A04 8840	2050
GO TO 2100	A04 8850	2051
2090 WRITE (KOUT,1000)	A04 8860	2052
WRITE (KOUT,1000)	A04 8870	2053
2100 CONTINUE	A04 8880	2054
C	A04 8890	2055
C	A04 8900	2056
SUMR(1,NSF,1) = ( SUML(1,NSF,1)*COS(A) - SUML(1,NSF,3)*SIN(A)	A04 8910	2057
SUMR(1,NSF,2) = SUML(1,NSF,2)	A04 8920	2058
SUMR(1,NSF,3) = (-SUML(1,NSF,3)*COS(A) - SUML(1,NSF,1)*SIN(A)	A04 8930	2059
C	A04 8940	2060
SUMR(2,NSF,1) = SUMR(1,NSF,1)	A04 8950	2061
SUMR(2,NSF,2) = SUMR(1,NSF,2)	A04 8960	2062
SUMR(2,NSF,3) = SUMR(1,NSF,3)	A04 8970	2063
C	A04 8980	2064
SUML(1,NSF,3) = -SUML(1,NSF,3)	A04 8990	2065
SUML(2,NSF,3) = -SUML(1,NSF,3)	A04 9000	2066
C	A04 9010	2067
ZUMR(1,NSF,1) = ( ZUML(1,NSF,1)*COS(A) - ZUML(1,NSF,3)*SIN(A)	A04 9020	2068
ZUMR(1,NSF,2) = ZUML(1,NSF,2)	A04 9030	2069
ZUMR(1,NSF,3) = (-ZUML(1,NSF,3)*COS(A) - ZUML(1,NSF,1)*SIN(A)	A04 9040	2070
C	A04 9050	2071
ZUMR(2,NSF,1) = ZUMR(1,NSF,1)	A04 9060	2072
ZUMR(2,NSF,2) = ZUMR(1,NSF,2)	A04 9070	2073
ZUMR(2,NSF,3) = ZUMR(1,NSF,3)	A04 9080	2074
C	A04 9090	2075
ZUML(1,NSF,3) = -ZUML(1,NSF,3)	A04 9100	2076
ZUML(2,NSF,3) = -ZUML(1,NSF,3)	A04 9110	2077
C	A04 9120	2078
2110 CONTINUE	A04 9130	2079
C	A04 9140	2080
C	A04 9150	2081
C	A04 9160	2082
DO 2130 N=NSURF1,NSURF2	A04 9170	2083
C	A04 9180	2084
DO 2120 L=1,3	A04 9190	2085
ZUML(2,N,L) = ZUML(1,N,L)*FACN(1,1)	A04 9200	2086
ZUMR(2,N,L) = ZUMR(1,N,L)*FACN(1,1)	A04 9210	2087
ZUML(1,N,L) = ZUML(1,N,L)*FACN(N,1)	A04 9220	2088
ZUMR(1,N,L) = ZUMR(1,N,L)*FACN(N,1)	A04 9230	2089
SUML(2,N,L) = SUML(1,N,L)*FACN(1,1)	A04 9240	2090
SUMR(2,N,L) = SUMR(1,N,L)*FACN(1,1)	A04 9250	2091
SUML(1,N,L) = SUML(1,N,L)*FACN(N,1)	A04 9260	2092
2120 SUMR(1,N,L) = SUMR(1,N,L)*FACN(N,1)	A04 9270	2093
C	A04 9280	2094
ZUMP(1,N,1) = ZUMP(1,N,1)*FACN(N,2)	A04 9290	2095
ZUMP(1,N,2) = ZUMP(1,N,2)*FACN(N,3)	A04 9300	2096

ZUMP(1,N,3) = ZUMP(1,N,3)*FACN(N,3)	A04 9310	2097
ZUMP(2,N,1) = ZUMP(2,N,1)*FACN(1,2)	A04 9320	2098
ZUMP(2,N,2) = ZUMP(2,N,2)*FACN(1,3)	A04 9330	2099
ZUMP(2,N,3) = ZUMP(2,N,3)*FACN(1,3)	A04 9340	2100
C	A04 9350	2101
SUMP(1,N,1) = SUMP(1,N,1)*FACN(N,2)	A04 9360	2102
SUMP(1,N,2) = SUMP(1,N,2)*FACN(N,3)	A04 9370	2103
SUMP(1,N,3) = SUMP(1,N,3)*FACN(N,3)	A04 9380	2104
SUMP(2,N,1) = SUMP(2,N,1)*FACN(1,2)	A04 9390	2105
SUMP(2,N,2) = SUMP(2,N,2)*FACN(1,3)	A04 9400	2106
2130 SUMP(2,N,3) = SUMP(2,N,3)*FACN(1,3)	A04 9410	2107
C	A04 9420	2108
C	A04 9430	2109
DO 2150 N=2,NSURF2	A04 9440	2110
DO 2140 L=1,3	A04 9450	2111
ZUML(2,1,L) = ZUML(2,1,L) + ZUML(2,N,L)	A04 9460	2112
ZUMR(2,1,L) = ZUMR(2,1,L) + ZUMR(2,N,L)	A04 9470	2113
ZUMP(2,1,L) = ZUMP(2,1,L) + ZUMP(2,N,L)	A04 9480	2114
SUML(2,1,L) = SUML(2,1,L) + SUML(2,N,L)	A04 9490	2115
SUMR(2,1,L) = SUMR(2,1,L) + SUMR(2,N,L)	A04 9500	2116
2140 SUMP(2,1,L) = SUMP(2,1,L) + SUMP(2,N,L)	A04 9510	2117
2150 CONTINUE	A04 9520	2118
C	A04 9530	2119
DO 2160 L=1,3	A04 9540	2120
ZUMLG(1) = ZUMLG(1)*FACNG(1)	A04 9550	2121
2160 SUMLG(1) = SUMLG(1)*FACNG(1)	A04 9560	2122
ZUMLG(3) = -ZUMLG(3)	A04 9570	2123
SUMLG(3) = -SUMLG(3)	A04 9580	2124
C	A04 9590	2125
ZUMPG(1) = ZUMPG(1)*FACNG(2)	A04 9600	2126
ZUMPG(2) = ZUMPG(2)*FACNG(3)	A04 9610	2127
ZUMPG(3) = ZUMPG(3)*FACNG(3)	A04 9620	2128
C	A04 9630	2129
SUMPG(1) = SUMP(1)*FACNG(2)	A04 9640	2130
SUMPG(2) = SUMP(2)*FACNG(3)	A04 9650	2131
SUMPG(3) = SUMP(3)*FACNG(3)	A04 9660	2132
C	A04 9670	2133
ZACNG(2) = ZUMLG(1)*COSA + ZUMLG(3)*SINA	A04 9680	2134
ZACNG(3) = ZUMLG(2)	A04 9690	2135
ZACNG(1) = ZUMLG(3)*COSA - ZUMLG(1)*SINA	A04 9700	2136
C	A04 9710	2137
FACNG(2) = SUMLG(1)*COSA + SUMLG(3)*SINA	A04 9720	2138
FACNG(3) = SUMLG(2)	A04 9730	2139
FACNG(1) = SUMLG(3)*COSA - SUMLG(1)*SINA	A04 9740	2140
C	A04 9750	2141
C	A04 9760	2142
C	A04 9770	2143
C	A04 9780	2144
** LIFTING SURFACES AIRLOAD SECTION COEFFICIENTS **	A04 9790	2145
C	A04 9800	2146
DO 2360 NSF=NSURF1,NSURF2	A04 9810	2147
C	A04 9820	2148
NM = 0	A04 9830	2149
J1 = JN1(NSF)	A04 9840	2150
J2 = JN2(NSF)	A04 9850	2151
K2 = KN2(NSF)	A04 9860	2152
NZERO = JN0(NSF)	A04 9870	2153
N00 = NSS0(NSF)	A04 9880	2154
C	A04 9890	2155
SYMGF2 = SYMGF(NSF) -1.0	A04 9900	2156
SYMGF3 = -SYMGF(NSF) *2.0	A04 9910	2157
SPAN = WINGD(NSF,1)	A04 9920	2158
C	A04 9930	2159
DO 2330 J=NZERO,J2	A04 9940	2160
IF (JSTNGP(NSF).EQ.J) GO TO 2330	A04 9950	2161
C	A04 9960	2162
JPI = J +1	A04 9970	2163
NM = NM +1	A04 9980	2164
W1 = EW(J,1)	A04 9990	2165
W2 = EW(JPI,1)	A0410000	2166
WA = EWE(N00)	A0410010	2167
WB = 2.0*( W1-WA )	A0410020	2168
TEST = ABS( W1 - W2 ) - 0.001	A0410030	2169
IF (TEST) 2180,2180,2170	A0410040	2170
2170 WA = (W1+W2)/2.0	A0410050	2171
WB = ABS( W1-W2 )	A0410060	2172
2180 CONTINUE	A0410070	2173
RW = WA	A0410080	2174
C	A0410090	2175
CALL CORDF(W1,Y1,XL1,XT1,ZL1,EP1,CW1,CF1,CB1,TAD1,TAS1,RATS,M1,M2)	A0410100	2176
CALL CORDF(W2,Y2,XL2,XT2,ZL2,EP2,CW2,CF2,CB2,TAD2,TAS2,RATS,M1,M2)	A0410110	2177
CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TASD, RATS,M1,M2)	A0410120	2178
C	A0410130	2179
TANLE = (ELE(M2)-ELE(M1))/WB	A0410140	2180
FOSLE = SQRT(1.0 + TANLE**2)	A0410150	2181
XHE = 0.5*( XT1+XT2 -CF1-CF2 )	A0410160	2182
XHEE = 0.5*( XT1+XT2 -CB1-CB2 )	A0410170	2183
COSD = 1.0/SQRT( 1.0 + TAND**2 )	A0410180	2184
SIND = 1.0	A0410190	2185
IF(TAND.LT.0) SIND = -1.0	A0410200	2186
IF(COSD.GT.0.00001) SIND = TAND*COSD	A0410210	2187
CW = 0.5*( CW1+CW2 )	A0410220	2188
AREA = WB*CW*( COSD*SYMGF2 + SIND*SYMGF3 )	A0410230	2189
IF(AREA.LT.1.0E-6) AREA = WB*CW*( COSD*SYMGF3 + SIND*SYMGF2 )	A0410240	2190
XCO4 = 0.5*(XL1+XL2) + 0.25*CW	A0410250	2191
C	A0410260	2192
SCN = 0.0	A0410270	2193
SCX = 0.0	A0410280	2194
SPM = 0.0	A0410290	2195
SCL = 0.0	A0410300	2196
SCD = 0.0	A0410310	2197
C	A0410320	2198
C	A0410330	2199
DO 2250 K=1,K2	A0410340	2200
C	A0410350	2201
COS1(1) = VVINDX(IJ,K,1) + COSA	A0410360	2202
COS1(2) = VVINDX(IJ,K,2)		

C	COS1(3)= VVINDX(J,K,3) - SIN4	AD410370	2203
		AD410380	2204
C	DO 2190 L=1,3	AD410390	2205
	LP3= L +3	AD410400	2206
	B(L)= EV(J,K,L)	AD410410	2207
2190	D(L)= EV(JP1,K,L)	AD410420	2208
C		AD410430	2209
	SH1 = B(21)	AD410440	2210
C		AD410450	2211
	CALL FLAPS(NSF,w1,SH1,XT1,CF1,CB1,TAD1, B,COS3)	AD410460	2212
	CALL FLAPS(NSF,w2,SH2,XT2,CF2,CB2,TAD2, D,COS3)	AD410470	2213
C		AD410480	2214
	SUM8 = 0.0	AD410490	2215
	DO 2200 L=1,3	AD410500	2216
	P(L)= 0.5*( B(L) + D(L) )	AD410510	2217
	COS2(L)= D(L)-B(L)	AD410520	2218
2200	SUM8= SUM8 + COS2(L)**2	AD410530	2219
	SUM8 = SQRT(SUM8)	AD410540	2220
	DO 2210 L=1,3	AD410550	2221
2210	COS2(L)= COS2(L1)/SUM8	AD410560	2222
C		AD410570	2223
C		AD410580	2224
	CALL CROSP(COS1,COS2,COS3)	AD410590	2225
C		AD410600	2226
	SLIFT= EG(J,K)*SLP8	AD410610	2227
C		AD410620	2228
C		AD410630	2229
	DO 2220 L=1,3	AD410640	2230
2220	SUMSL(L)= SLIFT*COS3(L)	AD410650	2231
C		AD410660	2232
C		AD410670	2233
	DCN = -SUMSL(3)*SYMGF2 + SUMSL(1)*SYMGF3	AD410680	2234
C		AD410690	2235
	SCN = SCN + DCN	AD410700	2236
	SCX = SCX + SUMSL(1)	AD410710	2237
	SPM = SPM - DCN*((P(1)-XCD4)/CW)	AD410720	2238
C		AD410730	2239
C		AD410740	2240
	SUM8= 0.0	AD410750	2241
	DO 2230 L=1,3	AD410760	2242
2230	SUM8= SUM8 + SUMSL(L)**2	AD410770	2243
	SUMSL(4)= SQRT(SUM8)	AD410780	2244
	DO 2240 L=1,3	AD410790	2245
2240	SUMSL(L1)= SUMSL(L)/SUMSL(4)	AD410800	2246
C		AD410810	2247
C		AD410820	2248
2250	CONTINUE	AD410830	2249
C		AD410840	2250
C		AD410850	2251
	SCN= SCN*(2.0/AREA)	AD410860	2252
	SCX= SCX*(2.0/AREA)	AD410870	2253
	SPM= SPM*(2.0/AREA)	AD410880	2254
C		AD410890	2255
	SCL= SYMGF2*(SCN*COSA-SCX*SINA)+SYMGF3*(SCN)	AD410900	2256
	SCD= SYMGF2*(SCX*SINA+SCN*SINA)+SYMGF3*(SCX*COSA)	AD410910	2257
C		AD410920	2258
	SCLCOR= SCL*CW/SPAN	AD410930	2259
C		AD410940	2260
	RY = EN(J,1,2)	AD410950	2261
	RZ = EN(J,1,3)	AD410960	2262
C		AD410970	2263
C		AD410980	2264
	IF (NM-1) 2260,2260,2310	AD410990	2265
2260	LIN= LIN +4	AD411000	2266
	IF (LINX-LIN) 2270,2280,2280	AD411010	2267
2270	CALL PAGE	AD411020	2268
	LIN= LIN +4	AD411030	2269
2280	WRITE (KOUT,1080)ASF,NSURF1,NSURF2	AD411040	2270
	LIN= LIN +2	AD411050	2271
	IF (LINX-LIN) 2290,2300,2300	AD411060	2272
2290	CALL PAGE	AD411070	2273
	LIN= LIN +2	AD411080	2274
2300	WRITE (KOUT,1090)	AD411090	2275
2310	LIN= LIN+1	AD411100	2276
	IF (LINX-LIN) 2290,2320,2320	AD411110	2277
2320	YTB= ( EN(J,1,2)*SYMGF2 + (EN(J2,1,3)-EN(J,1,3))*SYMGF3 )/SPAN	AD411120	2278
C		AD411130	2279
C		AD411140	2280
	WRITE (KOUT,1100)J,YOB,RY,RZ,RW,SCN,SCX,SCL,SCD,SPM,SCLCOR,(SUMSL(	AD411150	2281
	1),1=1,3)	AD411160	2282
	LIN= LIN +1	AD411170	2283
C		AD411180	2284
C		AD411190	2285
2330	CONTINUE	AD411200	2286
	LIN= LIN +2	AD411210	2287
	IF (LINX-LIN) 2340,2350,2350	AD411220	2288
2340	CALL PAGE	AD411230	2289
	GO TO 2360	AD411240	2290
2350	WRITE (KOUT,1000)	AD411250	2291
	WRITE (KOUT,1000)	AD411260	2292
2360	CONTINUE	AD411270	2293
C		AD411280	2294
C		AD411290	2295
C		AD411300	2296
C	** LIFTING SURFACES AIRLOAD SUMMARY **	AD411310	2297
C		AD411320	2298
	LIN = LIN + 12	AD411330	2299
C		AD411340	2300
	IF (LINX-LIN) 2370,2380,2380	AD411350	2301
2370	CALL PAGE	AD411360	2302
	LIN = LIN + 12	AD411370	2303
2380	WRITE (KOUT,1110)NSURF1,NSURF2	AD411380	2304
C		AD411390	2305
C		AD411400	2306
	DO 2410 N=1,NSURF2	AD411410	2307
C		AD411420	2308

	LIN = LIN + 2	A0411430	2309
	IF (LINX-LIN) 2390,2400,2400	A0411440	2310
2390	CALL PAGE	A0411450	2311
	LIN = LIN + 12	A0411460	2312
	WRITE (KOUT,1110)NSURF1,NSURF2	A0411470	2313
2400	CONTINUE	A0411480	2314
C		A0411490	2315
	WRITE (KOUT,1120)N,SUML(1,N,3),SUML(1,N,1),SUML(1,N,2),SUMR(1,N,3),SA0411500	A0411500	2316
	1,SUMR(1,N,1),SUMP(1,N,1),I=1,3,WINGD(N,11),WINGD(N,12),WINGD(N,6)A0411510	A0411510	2317
	2),WINGD(N,9),WINGD(N,1)	A0411520	2318
C		A0411530	2319
	WRITE (KOUT,1140)N,ZUML(1,N,3),ZUML(1,N,1),ZUML(1,N,2),ZUMR(1,N,3),A0411540	A0411540	2320
	1,ZUMR(1,N,1),ZUMP(1,N,1),I=1,3,WINGD(N,11),WINGD(N,12),WINGD(N,6)A0411550	A0411550	2321
	2),WINGD(N,9),WINGD(N,1)	A0411560	2322
C		A0411570	2323
2410	CONTINUE	A0411580	2324
C		A0411590	2325
	LIN = LIN + 11	A0411600	2326
	IF (LINX-LIN) 2420,2430,2430	A0411610	2327
2420	CALL PAGE	A0411620	2328
	LIN = LIN + 11	A0411630	2329
2430	CONTINUE	A0411640	2330
C		A0411650	2331
	WRITE (KOUT,1130)SUML(2,1,3),SUML(2,1,1),SUML(2,1,2),SUMR(2,1,3),SA0411660	A0411660	2332
	1,UMR(2,1,1),SUMP(2,1,1),I=1,3,WINGD(1,11),WINGD(1,12),WINGD(1,6),A0411670	A0411670	2333
	2,WINGD(1,9),WINGD(1,1),SUMLG(3),SUMLG(1),I=1,2,{FACNG(1),I=1,2},{A0411680	A0411680	2334
	3SUMPG(1),I=1,3,XCG,ZCG,REFS,REFC,REFB,ZUML(2,1,3),ZUML(2,1,1),ZUMA0411690	A0411690	2335
	4L(2,1,2),ZUMR(2,1,3),ZUMR(2,1,1),ZUMP(2,1,1),I=1,3,WINGD(1,11),WA0411700	A0411700	2336
	5INGD(1,12),WINGD(1,6),WINGD(1,9),WINGD(1,1),ZUMLG(3),ZUMLG(1),I=1A0411710	A0411710	2337
	6,2},{ZACNG(1),I=1,2},{ZUMPG(1),I=1,3,XCG,ZCG,REFS,REFC,REFB,DETERA0411720	A0411720	2338
	7M,SCALE	A0411730	2339
C		A0411740	2340
C		A0411750	2341
	RETURN	A0411760	2342
C		A0411770	2343
	END	A0411780	2344
7	FOR A05,A05	A05 10	2345
C		A05 20	2346
C		A05 30	2347
	SUBROUTINE ABORTJ(INDGO,TEST,ITEST)	A05 40	2348
		A05 50	2349
C		A05 60	2350
C	* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A05	A05 70	2351
C	* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A05	A05 80	2352
C	XX	A05 90	2353
C		A05 100	2354
C		A05 110	2355
	COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINK	A05 120	2356
	1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LDRAG, COLCOP	A05 130	2357
	2 ,IFLG(20), EXECK(15)	A05 140	2358
C		A05 150	2359
	EQUIVALENCE (D,N)	A05 160	2360
C		A05 170	2361
	DATA CMK/0.90/	A05 180	2362
	DATA I5/5/,I10/10/,I100/100/,I60/60/,I25/30/	A05 190	2363
C		A05 200	2364
	1000 FORMAT(1X,/,3X,25H *** JOB ABORTED BECAUSE ,	A05 210	2365
	1 23HND.OF LIFTING SURFACES=,I2,17H EXCEEDS FIVE ***,/,3X,67(1H*) )	A05 220	2366
C		A05 230	2367
	1010 FORMAT(1X,/,3X,25H *** JOB ABORTED BECAUSE ,	A05 240	2368
	2 20HND.OF SPAN ELEMENTS=,I2,16H EXCEEDS 60 ***, /,3X,63(1H*) )	A05 250	2369
C		A05 260	2370
	1020 FORMAT(1X,/,3X,25H *** JOB ABORTED BECAUSE ,	A05 270	2371
	3 21HND.OF CHORD ELEMENTS=,I2,16H EXCEEDS TEN ***, /,3X,65(1H*) )	A05 280	2372
C		A05 290	2373
	1030 FORMAT(1X,/,3X,25H *** JOB ABORTED BECAUSE ,	A05 300	2374
	4 20HND.OF VORTEX MATRIX ELEMENTS=,I2,16H EXCEEDS 100 ***,/,3X,72(1H*) )	A05 310	2375
	*H*) )	A05 320	2376
C		A05 330	2377
	1040 FORMAT(1X,/,3X,25H *** JOB ABORTED BECAUSE ,	A05 340	2378
	5 9HMACH NO.=, F6.3, 17H EXCEEDS 0.90 ***,/, 3X, 57(1H*) )	A05 350	2379
C		A05 360	2380
	1050 FORMAT(1X,/,3X,25H *** JOB ABORTED BECAUSE ,	A05 370	2381
	6 17HND.SPAN STATIONS=,I2,15H EXCEEDS 25 ***,/,3X,59(1H*) )	A05 380	2382
C		A05 390	2383
	1060 FORMAT(1X,/,3X,25H *** JOB ABORTED BECAUSE ,	A05 400	2384
	7 18HND.CHORD STATIONS=,I2,15H EXCEEDS 10 ***,/,3X,60(1H*) )	A05 410	2385
C		A05 420	2386
	1070 FORMAT(1X,/,3X,25H *** JOB ABORTED BECAUSE ,	A05 430	2387
	8 20HND.OF SPAN ELEMENTS=,I2,18H NOT PERMITTED ***,/,3X,65(1H*) )	A05 440	2388
C		A05 450	2389
	1080 FORMAT(1X,/,3X,25H *** JOB ABORTED BECAUSE ,	A05 460	2390
	9 26HND.OF WING CHORD ELEMENTS=,I2,18H NOT PERMITTED ***,/,3X,71(1H*) )	A05 470	2391
	***) )	A05 480	2392
C		A05 490	2393
	1090 FORMAT(1X,/,3X,25H *** JOB ABORTED BECAUSE ,	A05 500	2394
	* 32HINPUT ERROR IN NSS FLAG, NSS(N)=I2,11H.LT.NSS(M)=I2,4H ***,	A05 510	2395
	* /,4X,75(1H*) )	A05 520	2396
C		A05 530	2397
	XX	A05 540	2398
C		A05 550	2399
C		A05 560	2400
C		A05 570	2401
C		A05 580	2402
	GO TO (1100,1110,1120,1130,1140,1150,1160,1170,1180,1190),NDGO	A05 590	2403
1100	IF (I5.LT.ITEST) WRITE (KOUT,1000)ITEST	A05 600	2404
	IF(I5.LT.ITEST) CALL EXIT	A05 610	2405
	RETURN	A05 620	2406
1110	IF (I60.LT.ITEST) WRITE (KOUT,1010)ITEST	A05 630	2407
	IF(I60.LT.ITEST) CALL EXIT	A05 640	2408
	RETURN	A05 650	2409
1120	IF (I10.LT.ITEST) WRITE (KOUT,1020)ITEST	A05 660	2410
	IF(I10.LT.ITEST) CALL EXIT	A05 670	2411

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RETURN	A05	680	2412
1130 IF (I100.LT.ITEST) WRITE (KOUT,1030)ITEST	A05	690	2413
IF(I100.LT.ITEST) CALL EXIT	A05	700	2414
RETURN	A05	710	2415
1140 IF (CMAX.LT.TEST) WRITE (KOUT,1040)ITEST	A05	720	2416
IF(CMAX.LT.TEST) CALL EXIT	A05	730	2417
RETURN	A05	740	2418
1150 IF (I125.LT.ITEST) WRITE (KOUT,1050)ITEST	A05	750	2419
IF(I125.LT.ITEST) CALL EXIT	A05	760	2420
RETURN	A05	770	2421
1160 IF (I110.LT.ITEST) WRITE (KOUT,1060)ITEST	A05	780	2422
IF(I110.LT.ITEST) CALL EXIT	A05	790	2423
RETURN	A05	800	2424
1170 IF (ITEST.LT.0) WRITE (KOUT,1070)ITEST	A05	810	2425
IF(ITEST.LT.0) CALL EXIT	A05	820	2426
RETURN	A05	830	2427
1180 IF (ITEST.LT.0) WRITE (KOUT,1080)ITEST	A05	840	2428
IF(ITEST.LT.0) CALL EXIT	A05	850	2429
RETURN	A05	860	2430
1190 N= TEST	A05	870	2431
IF (N.LE.ITEST) WRITE (KOUT,1090)N,ITEST	A05	880	2432
IF(N.LE.ITEST) CALL EXIT	A05	890	2433
RETURN	A05	900	2434
C	A05	910	2435
END	A05	920	2436
7 FOR A06,A06	A06	10	2437
C	A06	20	2438
C	A06	30	2439
SUBROUTINE CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CYB,TAND,TANS,R,M1,M)	A06	40	2440
C	A06	50	2441
* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A06	A06	60	2442
* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A06	A06	70	2443
C	A06	80	2444
XXA06	A06	90	2445
C	A06	100	2446
COMMON/DATA02/ N1ING, NFUS, NVTAIL, NSS(5), NSS0(5), NCS(5)	A06	110	2447
1,X(30),Y(30),Z(30),E(30),C(30),KOCR(30),FLAPC(30),TABC(30)	A06	120	2448
2,WSMOTH,EWE(30),ELE(30),ETE(30),EHE(30),EHEE(30)	A06	130	2449
3,KOC(10,5),ZOC(10,30)	A06	140	2450
C	A06	150	2451
C	A06	160	2452
XXA06	A06	170	2453
C	A06	180	2454
C	A06	190	2455
C	A06	200	2456
M= -1	A06	210	2457
NX= 30	A06	220	2458
DO 1020 L=2,NX	A06	230	2459
IF (M) 1000,1000,1020	A06	240	2460
1000 TEST= WA - EWE(L) -0.001	A06	250	2461
IF (TEST) 1010,1010,1020	A06	260	2462
1010 M=L	A06	270	2463
1020 CONTINUE	A06	280	2464
C	A06	290	2465
IF (M-2) 1030,1040,1040	A06	300	2466
1030 M=2	A06	310	2467
1040 M1= M-1	A06	320	2468
C	A06	330	2469
RATS=(WA-EWE(M1))/(EWE(M)-EWE(M1))	A06	340	2470
C	A06	350	2471
XLE = ELE(M1) + RATS*( ELE(M) - ELE(M1) )	A06	360	2472
XTE = ETE(M1) + RATS*( ETE(M) - ETE(M1) )	A06	370	2473
XHE = EHE(M1) + RATS*( EHE(M) - EHE(M1) )	A06	380	2474
XHEE= EHEE(M1)+ RATS*( EHEE(M) -EHEE(M1) )	A06	390	2475
EPS = E(M1) + RATS*( E(M)-E(M1) )	A06	400	2476
ZLE = Z(M1) + RATS*( Z(M)-Z(M1) )	A06	410	2477
CW = XTE - XLE	A06	420	2478
CF = XTE - XHE	A06	430	2479
CYB= XTE - XHEE	A06	440	2480
R = RATS	A06	450	2481
C	A06	460	2482
DY = Y(M)-Y(M1)	A06	470	2483
DW = EWE(M)-EWE(M1)	A06	480	2484
YA = Y(M1) + RATS*DY	A06	490	2485
TAND = 100000.0	A06	500	2486
TEST= ABS(DY) -0.001	A06	510	2487
C	A06	520	2488
IF (TEST) 1060,1060,1050	A06	530	2489
1050 TAND= (Z(M1)-Z(M))/DY	A06	540	2490
1060 TANS= (X(M)+C(M)*(0.25-XOCR(M1))-X(M1)-C(M1)*(0.25-XOCR(M1)))/DW	A06	550	2491
C	A06	560	2492
RETURN	A06	570	2493
XXXXXX	A06	580	2494
C	A06	590	2495
END	A06	600	2496
7 FOR A07,A07	A07	10	2497
C	A07	20	2498
C	A07	30	2499
SUBROUTINE CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF,ZF)	A07	40	2500
C	A07	50	2501
* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A07	A07	60	2502
* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A07	A07	70	2503
C	A07	80	2504
XXA07	A07	90	2505
C	A07	100	2506
DIMENSION ZOXY(10)	A07	110	2507
C	A07	120	2508
COMMON/DATA01/ KIN, KOUT, KTL, KT2, KT3, KREC, KFILE, LIN, LINX	A07	130	2509
1,RAO,PIE,CUTOFF1,CUTOFF2,DELALF,LFLAP,LORAG,COLOCP	A07	140	2510
2,IFLG(20),EXECK(15)	A07	150	2511



C	COMMON/DATA02/ NHING, NFUS, NVTAIL, NSS(5), NSSO(5), NCS(5)	A07	160	2512
	1, X(30), Y(30), Z(30), E(30), C(30), XOCR(30), FLAPC(30), TABC(30)	A07	170	2513
	2, WSMOTH, EWE(30), ELE(30), ETE(30), EHE(30), EHEE(30)	A07	180	2514
	3, XOC(10,5), ZOC(10,30)	A07	190	2515
C	XX	A07	200	2516
C		A07	210	2517
C		A07	220	2518
C		A07	230	2519
C		A07	240	2520
C		A07	250	2521
C		A07	260	2522
	IF(CW.LE=1.0E-4) RETURN	A07	270	2523
	DO 1000 L=1,NK	A07	280	2524
1000	ZOCY(L)= ZOC(L,M1) + RATS*(ZOC(L,M2)-ZOC(L,M1))	A07	290	2525
C		A07	300	2526
	XOCREF = XOCR(M1) + RATS*(XOCR(M2)-XOCR(M1))	A07	310	2527
	TANE = TAN(FPS/RAD)	A07	320	2528
	XOCT = (XF-XLE)/CW	A07	330	2529
C		A07	340	2530
	N2 = -1	A07	350	2531
	DO 1030 L=2,NK	A07	360	2532
	IF (N2) 1010,1010,1030	A07	370	2533
1010	TEST= XOCT - XOC(L,NSF) - 0.001	A07	380	2534
	IF (TEST) 1020,1020,1030	A07	390	2535
1020	N2=L	A07	400	2536
1030	CONTINUE	A07	410	2537
	IF (N2-1) 1040,1040,1050	A07	420	2538
1040	N2= 2	A07	430	2539
1050	N1= N2-1	A07	440	2540
C		A07	450	2541
	RAT = (XOCT - XOC(N1,NSF))/(XOC(N2,NSF)-XOC(N1,NSF))	A07	460	2542
	DELZ= CW*( ZOCY(N1) + RAT*( ZOCY(N2)-ZOCY(N1) ) )	A07	470	2543
C		A07	480	2544
	ZF = ZF + DELZ + TANE*( XF - XLE - CW*XOCREF )	A07	490	2545
C		A07	500	2546
	RETURN	A07	510	2547
C		A07	520	2548
	END	A07	530	2549
7 FOR A08,A08		A08	10	2550
C		A08	20	2551
C		A08	30	2552
	SUBROUTINE FLAPS(NSF,WA,SHEK,XTE,CF,CTAB,TAND, P,COSN)	A08	40	2553
C		A08	50	2554
	* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72	A08	60	2555
	* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971	A08	70	2556
C	XX	A08	80	2557
C		A08	90	2558
	REAL NOAIL,MOGO	A08	100	2559
	DIMENSION P(3), COSN(3)	A08	110	2560
C		A08	120	2561
	COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINK	A08	130	2562
	1, RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LORAG, COLOCP	A08	140	2563
	2, IFLG(20), EXECK(15)	A08	150	2564
C		A08	160	2565
	COMMON/DATA02/ NHING, NFUS, NVTAIL, NSS(5), NSSO(5), NCS(5)	A08	170	2566
	1, X(30), Y(30), Z(30), E(30), C(30), XOCR(30), FLAPC(30), TABC(30)	A08	180	2567
	2, WSMOTH, EWE(30), ELE(30), ETE(30), EHE(30), EHEE(30)	A08	190	2568
	3, XOC(10,5), ZOC(10,30)	A08	200	2569
C		A08	210	2570
	COMMON/DATA03/FLAPDJ(5),TABDJ(5),A1LDJ(2,5),DELTF1(5),DELTF2(5)	A08	220	2571
	1, WFF1(5), WFF2(5), WFF3(5), WFF4(5), WFF5(5)	A08	230	2572
	2, WFLAP1(5), WFLAP2(5), WFLAP3(5)	A08	240	2573
C		A08	250	2574
	XX	A08	260	2575
C		A08	270	2576
	N= NSF	A08	280	2577
	N10= NSF +10	A08	290	2578
	NOFLAP = IFLG(N10)	A08	300	2579
	IF(NOFLAP.LT.1) NOFLAP= 1	A08	310	2580
	NOTAB = NOFLAP - 1	A08	320	2581
C		A08	330	2582
	IF (NOFLAP) 1310,1310,1000	A08	340	2583
1000	XFLAP = P(1) - ( XTE - CF )	A08	350	2584
	XTAB = P(1) - ( XTE - CTAB )	A08	360	2585
	IF (XFLAP) 1310,1310,1010	A08	370	2586
1010	CONTINUE	A08	380	2587
C		A08	390	2588
	COSD = 1.0/SQRT(1.0+TAND**2)	A08	400	2589
	SINC = TAND*COSD	A08	410	2590
C		A08	420	2591
	COSX = COSN(1)	A08	430	2592
	COSY = COSN(2)*CCSD - COSN(3)*SIND	A08	440	2593
	COSZ = COSN(3)*CCSD + COSN(2)*SIND	A08	450	2594
C		A08	460	2595
	FLAPD = FLAPDJ(N)	A08	470	2596
	TABD = TABDJ(N)	A08	480	2597
	A1LD = A1LDJ(1,N)	A08	490	2598
	SIGN = 1.0	A08	500	2599
C		A08	510	2600
	IF (SHEK) 1020,1030,1030	A08	520	2601
1020	SIGN = -1.0	A08	530	2602
	A1LD = A1LDJ(2,N)	A08	540	2603
1030	CONTINUE	A08	550	2604
	NOAIL = ABS(A1LD) - 0.1	A08	560	2605
C		A08	570	2606
	DFLAP= 0.0	A08	580	2607
C		A08	590	2608
		A08	600	2609
		A08	610	2610
		A08	620	2611
		A08	630	2612
		A08	640	2613
		A08	650	2614

DAILD = 0.0	A08 660	2615
DTAB = 0.0	A08 670	2616
C	A08 680	2617
NO = NSSQ(N)	A08 690	2618
YA = WA - EWF(N0)	A08 700	2619
WFF32 = WFF31(N) + WFF22(N) - WFF21(N)	A08 710	2620
C	A08 720	2621
TST11 = YA - WFF11(N)	A08 730	2622
TST12 = YA - WFF12(N)	A08 740	2623
TST21 = YA - WFF21(N)	A08 750	2624
TST22 = YA - WFF22(N)	A08 760	2625
TST31 = YA - WFF31(N)	A08 770	2626
TST32 = YA - WFF32	A08 780	2627
C	A08 790	2628
C	A08 800	2629
IF (NOFLAP) 1120,1120,1040	A08 810	2630
1040 IF (WFLAP1(N)) 1CRD,1080,1050	A08 820	2631
1050 IF (TST11) 1120,1120,1060	A08 830	2632
1060 IF (TST12) 1070,1080,1080	A08 840	2633
1070 SMF = 0.5*( 1.0 + SIN( PIE*(TST11/DELTFL(N) -0.5) ) )	A08 850	2634
DFLAP = SMF*FLAPD	A08 860	2635
DTAB = SMF*TABD	A08 870	2636
GO TO 1120	A08 880	2637
1080 IF (TST21) 1090,1090,1100	A08 890	2638
1090 SMF = 1.0	A08 900	2639
DFLAP = SMF*FLAPD	A08 910	2640
DTAB = SMF*TABD	A08 920	2641
GO TO 1120	A08 930	2642
1100 IF (TST22) 1110,1120,1120	A08 940	2643
1110 SMF = 0.5*( 1.0 + SIN( PIE*(TST21/DELTFL(N) +0.5) ) )	A08 950	2644
DFLAP = SMF*FLAPD	A08 960	2645
DTAB = SMF*TABD	A08 970	2646
C	A08 980	2647
C	A08 990	2648
1120 IF (NDAIL) 1210,1210,1130	A08 1000	2649
1130 SMF = 1.0	A08 1010	2650
DAILD = SMF*AILD	A08 1020	2651
1140 IF (TST21) 1150,1150,1160	A08 1030	2652
1150 SMF = 0.0	A08 1040	2653
DAILD = SMF*AILD	A08 1050	2654
GO TO 1210	A08 1060	2655
1160 IF (TST22) 1170,1180,1180	A08 1070	2656
1170 SMF = 0.5*( 1.0 + SIN( PIE*(TST21/DELTFL(N) -0.5) ) )	A08 1080	2657
DAILD = SMF*AILD	A08 1090	2658
GO TO 1210	A08 1100	2659
1180 IF (TST31) 1210,1190,1190	A08 1110	2660
1190 IF (TST32) 1200,1150,1150	A08 1120	2661
1200 SMF = 0.5*( 1.0 + SIN( PIE*(TST31/DELTFL(N) +0.5) ) )	A08 1130	2662
DAILD = SMF*AILD	A08 1140	2663
C	A08 1150	2664
1210 CONTINUE	A08 1160	2665
C	A08 1170	2666
C	A08 1180	2667
IF (XTAB) 1260,1220,1220	A08 1190	2668
1220 NOGO = ABS( DTAB ) -0.1	A08 1200	2669
IF (NOGO) 1260,1230,1230	A08 1210	2670
1230 TANF = TAN( DTAB/RA0 )	A08 1220	2671
COSF = 1.0/SQRT(1.0+TANF**2)	A08 1230	2672
SINF = TANF*COSF	A08 1240	2673
DNOR = XTAB*SINF	A08 1250	2674
C	A08 1260	2675
XCOS = COSX*COSF - COSZ*SINF	A08 1270	2676
ZCOS = COSZ*COSF + COSX*SINF	A08 1280	2677
C	A08 1290	2678
COSX = XCOS	A08 1300	2679
COSZ = ZCOS	A08 1310	2680
C	A08 1320	2681
IF (LFLAP) 1240,1240,1250	A08 1330	2682
1240 P(1) = P(1) - XTAB*(1.0-COSF)	A08 1340	2683
P(2) = P(2) + DNOR*SIND	A08 1350	2684
P(3) = P(3) + DNOR*COSD	A08 1360	2685
1250 CONTINUE	A08 1370	2686
C	A08 1380	2687
C	A08 1390	2688
1260 NOGO = ABS( DFLAP + DAILD ) - 0.1	A08 1400	2689
IF (NOGO) 1300,1300,1270	A08 1410	2690
1270 TANF = TAN( DFLAP + DAILD )/RAC	A08 1420	2691
COSF = 1.0/SQRT(1.0+TANF**2)	A08 1430	2692
SINF = TANF*COSF	A08 1440	2693
DNOR = XFLAP*SINF	A08 1450	2694
C	A08 1460	2695
XCOS = COSX*COSF - COSZ*SINF	A08 1470	2696
ZCOS = COSZ*COSF + COSX*SINF	A08 1480	2697
C	A08 1490	2698
COSX = XCOS	A08 1500	2699
COSZ = ZCOS	A08 1510	2700
C	A08 1520	2701
IF (LFLAP) 1280,1280,1290	A08 1530	2702
1280 P(1) = P(1) - XFLAP*(1.0-COSF)	A08 1540	2703
P(2) = P(2) + DNOR*SIND	A08 1550	2704
P(3) = P(3) + DNOR*COSD	A08 1560	2705
1290 CONTINUE	A08 1570	2706
C	A08 1580	2707
C	A08 1590	2708
1300 CONTINUE	A08 1600	2709
C	A08 1610	2710
COSN(1) = COSX	A08 1620	2711
COSN(2) = COSY*COSD + COSZ*SIND	A08 1630	2712
COSN(3) = COSZ*COSD - COSY*SIND	A08 1640	2713
C	A08 1650	2714
C	A08 1660	2715
1310 RETURN	A08 1670	2716
C	A08 1680	2717
END	A08 1690	2718

V FOR A09,A09	A09	10	2719
C	A09	20	2720
C	A09	30	2721
C	A09	40	2722
C	A09	50	2723
C	A09	60	2724
C	A09	70	2725
C	A09	80	2726
C	A09	90	2727
C	A09	100	2728
C	A09	110	2729
C	A09	120	2730
C	A09	130	2731
C	A09	140	2732
C	A09	150	2733
C	A09	160	2734
C	A09	170	2735
C	A09	180	2736
C	A09	190	2737
C	A09	200	2738
C	A09	210	2739
C	A09	220	2740
C	A09	230	2741
C	A09	240	2742
C	A09	250	2743
C	A09	260	2744
C	A09	270	2745
C	A09	280	2746
V FOR A10,A10	A10	10	2747
C	A10	20	2748
C	A10	30	2749
C	A10	40	2750
C	A10	50	2751
C	A10	60	2752
C	A10	70	2753
C	A10	80	2754
C	A10	90	2755
C	A10	100	2756
C	A10	110	2757
C	A10	120	2758
C	A10	130	2759
C	A10	140	2760
C	A10	150	2761
C	A10	160	2762
C	A10	170	2763
C	A10	180	2764
C	A10	190	2765
C	A10	200	2766
C	A10	210	2767
C	A10	220	2768
C	A10	230	2769
C	A10	240	2770
C	A10	250	2771
C	A10	260	2772
C	A10	270	2773
C	A10	280	2774
C	A10	290	2775
C	A10	300	2776
C	A10	310	2777
C	A10	320	2778
C	A10	330	2779
C	A10	340	2780
C	A10	350	2781
C	A10	360	2782
C	A10	370	2783
C	A10	380	2784
C	A10	390	2785
C	A10	400	2786
C	A10	410	2787
C	A10	420	2788
C	A10	430	2789
C	A10	440	2790
C	A10	450	2791
C	A10	460	2792
C	A10	470	2793
C	A10	480	2794
C	A10	490	2795
C	A10	500	2796
C	A10	510	2797
C	A10	520	2798
C	A10	530	2799
V FOR A11,A11	A11	10	2800
C	A11	20	2801
C	A11	30	2802
C	A11	40	2803
C	A11	50	2804
C	A11	60	2805
C	A11	70	2806
C	A11	80	2807
C	A11	90	2808
C	A11	100	2809
C	A11	110	2810
C	A11	120	2811
C	A11	130	2812
C	A11	140	2813
C	A11	150	2814
C	A11	160	2815
C	A11	170	2816
C	A11	180	2817
C	A11	190	2818

CALL ROTATE( XLE,ZLE, ZERC,ZERO, PHI, ZERO,ZERO, XLE,ZLE )	A11	200	2819
CALL ROTATE( YLE,XLE, ZERO,ZERO, PHI, ZERO,ZERO, YLE,XLE )	A11	210	2820
CALL ROTATE( YLE,ZLE, ZERC,ZERO, PHI, ZERO,ZERO, YLE,ZLE )	A11	220	2821
C		A11	230
RETURN		A11	240
C	XXXXXX	A11	250
C		A11	260
END		A11	270
V FOR A12,A12	A12	10	2827
C		A12	20
C		A12	30
SUBROUTINE ROTATE( X,Y, XO,YO, PHI, XF,YF, XT,YT )	A12	40	2830
C		A12	50
* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72	*A12	60	2832
* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971	*A12	70	2833
C		A12	80
XX	A12	90	2835
C		A12	100
KS = X-XO	A12	110	2836
YS = Y-YO	A12	120	2837
RHO= SQRT( KS**2 + YS**2)	A12	130	2838
ERRQR= 0.0001	A12	140	2839
TESTX= ABS(XS)-ERRQR	A12	150	2840
TESTY= ABS(YS)-ERRQR	A12	160	2841
IF (TESTX) 1000,1000,1030	A12	170	2842
1000 IF (TESTY) 1010,1010,1020	A12	180	2843
1010 ZET= 0.0	A12	190	2844
GO TO 1110	A12	200	2845
1020 ZET= 1.570795*(YS/ABS(YS)) - XS/YS	A12	210	2846
GO TO 1110	A12	220	2847
1030 ZET= ABS(YS/XS)	A12	230	2848
IF (TESTY) 1050,1050,1040	A12	240	2849
1040 ZET=ATAN(ZET)	A12	250	2850
1050 CONTINUE	A12	260	2851
IF (XS) 1070,1060,1060	A12	270	2852
1060 IF (YS) 1100,1110,1110	A12	280	2853
1070 IF (YS) 1090,1080,1080	A12	290	2854
1080 ZET= 3.14159 - ZET	A12	300	2855
GO TO 1110	A12	310	2856
1090 ZET= 3.14159 + ZET	A12	320	2857
GO TO 1110	A12	330	2858
1100 ZET= 6.28318 - ZET	A12	340	2859
1110 CONTINUE	A12	350	2860
ZPP= PHI + ZET	A12	360	2861
XR = RHO*COS(ZPP)	A12	370	2862
YR = RHO*SIN(ZPP)	A12	380	2863
XT= XF + XR	A12	390	2864
YT= YF + YR	A12	400	2865
C		A12	410
RETURN		A12	420
C	XXXXXX	A12	430
C		A12	440
END		A12	450
V FOR A13,A13	A13	10	2872
C		A13	20
C		A13	30
SUBROUTINE VORTEX(P,B,D,TANA,GAMA, VI,VCOS)	A13	40	2873
C		A13	50
* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72	*A13	60	2874
* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971	*A13	70	2875
C		A13	80
XX	A13	90	2876
C		A13	100
DIMENSION P(3),B(3),D(3)	A13	110	2877
DIMENSION COS(3),COS2(3),COS3(3), X(3),A(3),VCOS(3)	A13	120	2878
DIMENSION G(3)	A13	130	2879
C		A13	140
COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINK	A13	150	2880
1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LDRAG, COLOCP	A13	160	2881
2 ,IFLG(20), EXECK(15)	A13	170	2882
C		A13	180
NAMLIST/DEBUG1/P,B,D,TANA,GAMA,PSIF,VCOS	A13	190	2883
NAMLIST/DEBUG2/PSIF,VCOS	A13	200	2884
NAMLIST/DEBUG3/PSIF,VCOS	A13	210	2885
C		A13	220
1000 FORMAT(1X,/,1X)	A13	230	2886
C		A13	240
XX	A13	250	2887
C		A13	260
C		A13	270
C		A13	280
NOTE= IFLG(20) - 8	A13	290	2888
TANAS= TANA**2	A13	300	2889
COSA= 1.0 - TANAS/2.0	A13	310	2890
IF (TANAS-0.0001) 1020,1010,1010	A13	320	2891
1010 COSA= 1.0/SQRT(1-TANAS+1.0)	A13	330	2892
1020 SINA= COSA*TANA	A13	340	2893
C		A13	350
SCALE= SQRT((D(1)-B(1))**2+(D(2)-B(2))**2+(D(3)-B(3))**2)	A13	360	2894
DO 1030 K=1,3	A13	370	2895
X(K)= (P(K)-0.5*(B(K)+D(K)))/SCALE	A13	380	2896
A(K)= (0.5*(D(K)-B(K)))/SCALE	A13	390	2897
1030 VCOS(K)= 0.0	A13	400	2898
C		A13	410
C		A13	420
C		A13	430
* SEGMENT INF-A-B *	A13	440	2899
C		A13	450
H5 = TANA*( X(1)+ A(1))	A13	460	2900
C		A13	470

HS1 = (X(1)+A(1))**2 + H5**2	A13 480	2919
HS2 = (X(2)+A(2))**2 + (X(3)+A(3)-H5)**2	A13 490	2920
HS3 = (X(1)+A(1))**2 + (X(2)+A(2))**2 + (X(3)+A(3))**2	A13 500	2921
H1 = SQRT(HS1)	A13 510	2922
H2 = SQRT(HS2)	A13 520	2923
C	A13 530	2924
COSG= 0.0	A13 540	2925
SING= 1.0	A13 550	2926
TEST = CUTOFL - H1	A13 560	2927
C	A13 570	2928
IF (TEST) 1040,1050,1050	A13 580	2929
1040 COSG= (HS3-HS1-HS2)/(2.0*H1*H2)	A13 590	2930
SING= SQRT(ABS(1.0-COSG**2))	A13 600	2931
1050 CONTINUE	A13 610	2932
C	A13 620	2933
R = H2*SING	A13 630	2934
H4 = H2*COSG	A13 640	2935
SH14= H1+H4	A13 650	2936
C	A13 660	2937
PSIF= ( 1.0 +SH14/SQRT(SH14**2+R**2) )/R	A13 670	2938
C	A13 680	2939
COS1(1)= COSA	A13 690	2940
COS1(2)= 0.0	A13 700	2941
COS1(3)= SINA	A13 710	2942
COS2(1)= ( X(1)+A(1)-SH14*COSA )/R	A13 720	2943
COS2(2)= ( X(2)+A(2) )/R	A13 730	2944
COS2(3)= ( X(3)+A(3)-SH14*SINA )/R	A13 740	2945
C	A13 750	2946
CALL CROSP( COS1,COS2,COS3)	A13 760	2947
C	A13 770	2948
DO 1060 K=1,3	A13 780	2949
1060 VCOS(K)= PSIF*CCS3(K)	A13 790	2950
C	A13 800	2951
IF (NOTE) 1080,1070,1070	A13 810	2952
1070 WRITE (KOUT,1000)	A13 820	2953
WRITE (KOUT,DEBUG1)	A13 830	2954
1080 CONTINUE	A13 840	2955
C	A13 850	2956
C	A13 860	2957
C	A13 870	2958
* SEGMENT D-E-INF *	A13 880	2959
C	A13 890	2960
H5 = TANA*(X(1)-A(1))	A13 900	2961
C	A13 910	2962
HS1 = (X(1)-A(1))**2 + H5**2	A13 920	2963
HS2 = (X(2)-A(2))**2 + (X(3)-A(3)-H5)**2	A13 930	2964
HS3 = (X(1)-A(1))**2 + (X(2)-A(2))**2 + (X(3)-A(3))**2	A13 940	2965
H1 = SQRT(HS1)	A13 950	2966
H2 = SQRT(HS2)	A13 960	2967
C	A13 970	2968
COSG= 0.0	A13 980	2969
SING= 1.0	A13 990	2970
TEST = CUTOFL - H1	A13 1000	2971
C	A13 1010	2972
IF (TEST) 1090,1100,1100	A13 1020	2973
1090 COSG= (HS3-HS1-HS2)/(2.0*H1*H2)	A13 1030	2974
SING= SQRT(ABS(1.0-COSG**2))	A13 1040	2975
1100 CONTINUE	A13 1050	2976
C	A13 1060	2977
R = H2*SING	A13 1070	2978
H4 = H2*COSG	A13 1080	2979
SH14= H1+H4	A13 1090	2980
C	A13 1100	2981
PSIF= (-1.0 -SH14/SQRT(SH14**2+R**2) )/R	A13 1110	2982
C	A13 1120	2983
COS1(1)= COSA	A13 1130	2984
COS1(2)= 0.0	A13 1140	2985
COS1(3)= SINA	A13 1150	2986
COS2(1)= ( X(1)-A(1)-SH14*COSA )/R	A13 1160	2987
COS2(2)= ( X(2)-A(2) )/R	A13 1170	2988
COS2(3)= ( X(3)-A(3)-SH14*SINA )/R	A13 1180	2989
C	A13 1190	2990
CALL CROSP(COS1,COS2,COS3)	A13 1200	2991
C	A13 1210	2992
DO 1110 K=1,3	A13 1220	2993
1110 VCOS(K)= VCOS(K) + PSIF*CCS3(K)	A13 1230	2994
C	A13 1240	2995
IF (NOTE) 1130,1120,1120	A13 1250	2996
1120 WRITE (KOUT,DEBUG2)	A13 1260	2997
1130 CONTINUE	A13 1270	2998
C	A13 1280	2999
C	A13 1290	3000
C	A13 1300	3001
* SEGMENT B-C-D *	A13 1310	3002
C	A13 1320	3003
HS1 = 4.0*( A(1)**2 + A(2)**2 + A(3)**2 )	A13 1330	3004
HS2 = (X(1)-A(1))**2 + (X(2)-A(2))**2 + (X(3)-A(3))**2	A13 1340	3005
HS3 = (X(1)+A(1))**2 + (X(2)+A(2))**2 + (X(3)+A(3))**2	A13 1350	3006
H1 = SQRT(HS1)	A13 1360	3007
H2 = SQRT(HS2)	A13 1370	3008
C	A13 1380	3009
COSG= (HS3-HS1-HS2)/(2.0*H1*H2)	A13 1390	3010
SING= SQRT(ABS(1.0-COSG**2))	A13 1400	3011
PSIF= 0.0	A13 1410	3012
TEST = ABS(SING) - CUTOF2	A13 1420	3013
C	A13 1430	3014
IF (TEST) 1170,1170,1140	A13 1440	3015
1140 CONTINUE	A13 1450	3016
C	A13 1460	3017
R = H2*SING	A13 1470	3018
C	A13 1480	3019
TEST = R/H1 - 10.0*CUTOFL	A13 1490	3020
IF (TEST) 1170,1170,1150	A13 1500	3021
1150 CONTINUE	A13 1510	3022
C	A13 1520	3023
RS = R**2	A13 1530	3024

		3025
H4 = H2*CCSG	A13 1540	3025
SH14= H1+H4	A13 1550	3026
Y1= 1.0 + 2.0*H4/H1	A13 1560	3027
PSIF= (SH14/SQRT(SH14**2+RS) -H4/SQRT(H4**2+PS))1/R	A13 1570	3028
	A13 1580	3029
	A13 1590	3030
DO 1160 K=1,3	A13 1600	3031
G(K)= A(K)*T1	A13 1610	3032
CCS1(K)= (G(K)-X(K))/R	A13 1620	3033
1160 CCS2(K)= -2.0*A(K)/H1	A13 1630	3034
	A13 1640	3035
CALL CROSP(CCS1,CCS2,CCS3)	A13 1650	3036
	A13 1660	3037
1170 CONTINUE	A13 1670	3038
	A13 1680	3039
V2= 0.0	A13 1690	3040
	A13 1700	3041
DO 1180 K=1,3	A13 1710	3042
VCOS(K)= VCOS(K) + PSIF*CCS3(K)	A13 1720	3043
1180 V2= V2 + VCOS(K)**2	A13 1730	3044
	A13 1740	3045
IF (NOTE) 1200,1190,1190	A13 1750	3046
1190 WRITE (KOUT,DBUG,3)	A13 1760	3047
LTN= LTNX - 10	A13 1770	3048
1200 CONTINUE	A13 1780	3049
	A13 1790	3050
V1= SQRT(V2)	A13 1800	3051
DO 1210 K=1,3	A13 1810	3052
1210 VCOS(K)= VCOS(K)/V1	A13 1820	3053
	A13 1830	3054
V1= V1*(GAMA/SCALE)	A13 1840	3055
	A13 1850	3056
RETURN	A13 1860	3057
XXXXXX	A13 1870	3058
	A13 1880	3059
END	A13 1890	3060
7 FOR A14,A14	A14 10	3061
	A14 20	3062
	A14 30	3063
SUBROUTINE DMATINIA,N,DETERM	A14 40	3064
	A14 50	3065
MATRIX INVERSION WITH ACCOMPANYING SOLUTION OF LINEAR EQUATIONS	A14 60	3066
* VERSION 2 ROUTINE (DOUBLE PRECISION-ANGLEV MATINV SUBROUTINE) *	A14 70	3067
* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *	A14 80	3068
* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *	A14 90	3069
XX	A14 100	3070
	A14 110	3071
	A14 120	3072
	A14 130	3073
DOUBLE PRECISION R1,R2,DETERM,AMAX,T,SWAP,PIVOT,PIVOT1	A14 140	3074
DOUBLE PRECISION A(100,100), B(1,1)	A14 150	3075
DIMENSION IPIVOT(100),INDEX(100,2)	A14 160	3076
EQUIVALENCE (IROW,JROW), (ICOLUJ,COLUMJ), (AMAX, T, SWAP)	A14 170	3077
M= 0	A14 180	3078
XX	A14 190	3079
	A14 200	3080
	A14 210	3081
	A14 220	3082
	A14 230	3083
INITIALIZATION	A14 240	3084
	A14 250	3085
1000 ISCALE=0	A14 260	3086
1010 P1 = 1.E36	A14 270	3087
1020 R2=1.0/R1	A14 280	3088
1030 DETERM=1.0	A14 290	3089
1040 DO 1050 J=1,N	A14 300	3090
1050 IPIVOT(J)=0	A14 310	3091
1060 DO 1630 I=1,N	A14 320	3092
	A14 330	3093
SEARCH FOR PIVOT ELEMENT	A14 340	3094
	A14 350	3095
1070 AMAX=0.0	A14 360	3096
1080 DO 1170 J=1,N	A14 370	3097
1090 IF (IPIVOT(J)-1) 1100,1170,1100	A14 380	3098
1100 DO 1160 K=1,N	A14 390	3099
1110 IF (IPIVOT(K)-1) 1120,1160,1150	A14 400	3100
1120 IF (DABS(AMAX)-DABS(A(I,J,K))) 1130,1160,1160	A14 410	3101
1130 IROW=J	A14 420	3102
1140 ICOLUM=K	A14 430	3103
1150 AMAX=A(I,J,K)	A14 440	3104
1160 CONTINUE	A14 450	3105
1170 CONTINUE	A14 460	3106
IF (AMAX) 1190,1180,1190	A14 470	3107
1180 DETERM=0.0	A14 480	3108
ISCALE=0	A14 490	3109
GO TO 1750	A14 500	3110
XXXXXX	A14 510	3111
	A14 520	3112
	A14 530	3113
1190 IPIVOT(ICOLUM)=IPIVOT(ICOLUM)+1	A14 540	3114
	A14 550	3115
INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL	A14 560	3116

1280	SWAP=B(IROW,L)	A14	680	3128
1290	B(IROW,L)=B(ICOLU,L)	A14	690	3129
1300	B(ICOLU,L)=SWAP	A14	700	3130
1310	INDEX(I,1)=IROW	A14	710	3131
1320	INDEX(I,2)=ICOLU	A14	720	3132
1330	PIVOT=A(ICOLU,ICOLU)	A14	730	3133
	IF (PIVOT) 1340,1180,1340	A14	740	3134
C		A14	750	3135
C	SCALE THE DETERMINANT	A14	760	3136
C		A14	770	3137
1340	PIVOT=PIVOT	A14	780	3138
1350	IF (DABS(DETERM)-R1) 1380,1360,1360	A14	790	3139
1360	DETERM=DETERM/R1	A14	800	3140
	ISCALE=ISCALE+1	A14	810	3141
	IF (DABS(DETERM)-R1) 1410,1370,1370	A14	820	3142
1370	DETERM=DETERM/R1	A14	830	3143
	ISCALE=ISCALE+1	A14	840	3144
	GO TO 1410	A14	850	3145
1380	IF (DABS(DETERM)-R2) 1390,1390,1410	A14	860	3146
1390	DETERM=DETERM*R1	A14	870	3147
	ISCALE=ISCALE-1	A14	880	3148
	IF (DABS(DETERM)-R2) 1400,1400,1410	A14	890	3149
1400	DETERM=DETERM*R1	A14	900	3150
	ISCALE=ISCALE-1	A14	910	3151
1410	IF (DABS(PIVOT)-R1) 1440,1420,1420	A14	920	3152
1420	PIVOT=PIVOT/R1	A14	930	3153
	ISCALE=ISCALE+1	A14	940	3154
	IF (DABS(PIVOT)-R1) 1470,1430,1430	A14	950	3155
1430	PIVOT=PIVOT/R1	A14	960	3156
	ISCALE=ISCALE+1	A14	970	3157
	GO TO 1470	A14	980	3158
1440	IF (DABS(PIVOT)-R2) 1450,1450,1470	A14	990	3159
1450	PIVOT=PIVOT*R1	A14	1000	3160
	ISCALE=ISCALE-1	A14	1010	3161
	IF (DABS(PIVOT)-R2) 1460,1460,1470	A14	1020	3162
1460	PIVOT=PIVOT*R1	A14	1030	3163
	ISCALE=ISCALE-1	A14	1040	3164
1470	DETERM=DETERM*PIVOT	A14	1050	3165
C		A14	1060	3166
C	DIVIDE PIVOT ROW BY PIVOT ELEMENT	A14	1070	3167
C		A14	1080	3168
1480	A(ICOLU,ICOLU)=1.0	A14	1090	3169
1490	DO 1500 L=1,N	A14	1100	3170
1500	A(ICOLU,L)=A(ICOLU,L)/PIVOT	A14	1110	3171
C		A14	1120	3172
C		A14	1130	3173
1510	IF (M) 1540,1540,1520	A14	1140	3174
1520	DO 1530 L=1,M	A14	1150	3175
1530	B(ICOLU,L)=B(ICOLU,L)/PIVOT	A14	1160	3176
C		A14	1170	3177
C	REDUCE NON-PIVOT ROWS	A14	1180	3178
C		A14	1190	3179
1540	DO 1630 LI=1,M	A14	1200	3180
1550	IF (LI-ICOLU) 1560,1630,1560	A14	1210	3181
1560	T=A(LI,ICOLU)	A14	1220	3182
1570	A(LI,ICOLU)=0.0	A14	1230	3183
1580	DO 1590 L=1,N	A14	1240	3184
1590	A(LI,L)=A(LI,L)-A(ICOLU,L)*T	A14	1250	3185
C		A14	1260	3186
C		A14	1270	3187
1600	IF (M) 1630,1630,1610	A14	1280	3188
1610	DO 1620 L=1,M	A14	1290	3189
1620	B(LI,L)=B(LI,L)-B(ICOLU,L)*T	A14	1300	3190
1630	CONTINUE	A14	1310	3191
C		A14	1320	3192
C	INTERCHANGE COLUMNS	A14	1330	3193
C		A14	1340	3194
1640	DO 1740 I=1,N	A14	1350	3195
1650	L=N+1-I	A14	1360	3196
1660	IF (INDEX(I,1)-INDEX(L,2)) 1670,1740,1670	A14	1370	3197
1670	JROW=INDEX(L,1)	A14	1380	3198
1680	JCOLU=INDEX(L,2)	A14	1390	3199
1690	DO 1730 K=L,N	A14	1400	3200
1700	SWAP=A(K,JROW)	A14	1410	3201
1710	A(K,JROW)=A(K,JCOLU)	A14	1420	3202
1720	A(K,JCOLU)=SWAP	A14	1430	3203
1730	CONTINUE	A14	1440	3204
1740	CONTINUE	A14	1450	3205
1750	RETURN	A14	1460	3206
C	XXXXXX	A14	1470	3207
C		A14	1480	3208
C	END	A14	1490	3209
V FOR A15,A15		A15	10	3210
C		A15	20	3211
C		A15	30	3212
C	SUBROUTINE DQTP(A,B,C)	A15	40	3213
C		A15	50	3214
C	* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72	A15	60	3215
C	* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971	A15	70	3216
C		A15	80	3217
C	XX	A15	90	3218
C		A15	100	3219
C	DIMENSION A(3),B(3)	A15	110	3220
C	C= A(1)*B(1)+ A(2)*B(2)+ A(3)*B(3)	A15	120	3221
C		A15	130	3222
C	RETURN	A15	140	3223
C	XXXXXX	A15	150	3224
C		A15	160	3225
C	END	A15	170	3226
V FOR A16,A16		A16	10	3227

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C                                     A16 20      3228
C                                     A16 30      3229
C SUBROUTINE CROSP( A,B,C)          A16 40      3230
C                                     A16 50      3231
C * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A16 60      3232
C * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A16 70      3233
C                                     A16 80      3234
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA16 90      3235
C                                     A16 100     3236
C DIMENSION A(3),B(3),C(3)          A16 110    3237
C                                     A16 120    3238
C C(1)= A(2)*B(3) - A(3)*B(2)        A16 130    3239
C C(2)= A(3)*B(1) - A(1)*B(3)        A16 140    3240
C C(3)= A(1)*B(2) - A(2)*B(1)        A16 150    3241
C                                     A16 160    3242
C RETURN                             A16 170    3243
C XXXXXX                             A16 180    3244
C                                     A16 190    3245
C END                                 A16 200    3246

V FOR A17,A17                        A17 10      3247
C                                     A17 20      3248
C                                     A17 30      3249
C SUBROUTINE PAGE                     A17 40      3250
C                                     A17 50      3251
C * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A17 60      3252
C * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A17 70      3253
C                                     A17 80      3254
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA17 90      3255
C                                     A17 100     3256
C DIMENSION AILRDX(2)                A17 110    3257
C                                     A17 120    3258
C COMMON/DATA00/ TITLE(14), ALFA0, ZHO, CMAK A17 130    3259
C                                     A17 140    3260
C COMMON/DATA01/ KIA, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINK A17 150    3261
C 1,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LDRAG, COLOCP A17 160    3262
C 2,IFLG(20), EXECK(15)              A17 170    3263
C                                     A17 180    3264
C                                     A17 190    3265
C 1000 FORMAT(70H1JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16A17 200    3266
C 1 17 18 19 20 ,9A6,6H PAGE,/, A17 210    3267
C 2 2X,5HVALUE,LX,20I3, 7X,5HALFA=,F6.2,9H MACHNO=,F6.4,11H ALTITUDAA17 220    3268
C 3F=,F6.2, 7X,I4,/,1X)             A17 230    3269
C                                     A17 240    3270
C                                     A17 250    3271
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA17 260    3272
C                                     A17 270    3273
C                                     A17 280    3274
C IF (NSTU-1971) IC10,1020,1010      A17 290    3275
C 1010 NSTU= 1971                     A17 300    3276
C FLAPDX = 0.0                       A17 310    3277
C AILROX(1)= 0.0                     A17 320    3278
C AILROX(2)= 0.0                     A17 330    3279
C NP= 0                              A17 340    3280
C 1020 NP= NP+1                       A17 350    3281
C WRITE (KOUT,1000)(TITLE(I),I=1,9),(IFLG(I),I=1,20),ALFA0,CMAK,ZHO,A17 360    3282
C *NP                                 A17 370    3283
C LIN= 5                             A17 380    3284
C                                     A17 390    3285
C RETURN                             A17 400    3286
C XXXXXX                             A17 410    3287
C                                     A17 420    3288
C END                                 A17 430    3289

V FOR A18,A18                        A18 10      3290
C                                     A18 20      3291
C                                     A18 30      3292
C MAIN ROUTINE                       A18 40      3293
C TEST MATRIX INVERSION              A18 50      3294
C                                     A18 60      3295
C * TPW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A18 70      3296
C * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A18 80      3297
C                                     A18 90      3298
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA18 100    3299
C                                     A18 110    3300
C DOUBLE PRECISION DELTA,AMAT(60,60),CMAT(60,60) A18 120    3301
C DOUBLE PRECISION BMAT(100,100)     A18 130    3302
C                                     A18 140    3303
C 1000 FORMAT((10X,I5,2F14.4 ) )    A18 150    3304
C 1010 FORMAT( 1X,/,1X )             A18 160    3305
C 1020 FORMAT((10X,5(1PE14.6) ))    A18 170    3306
C                                     A18 180    3307
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA18 190    3308
C                                     A18 200    3309
C                                     A18 210    3310
C                                     A18 220    3311
C NDR= 5                             A18 230    3312
C                                     A18 240    3313
C AMAT(1,1) = 1.032                  A18 250    3314
C AMAT(1,2) = 7.865                   A18 260    3315
C AMAT(1,3) = 3.216                   A18 270    3316
C AMAT(1,4) = 3.031                   A18 280    3317
C AMAT(1,5) = 10.32                   A18 290    3318
C AMAT(2,1) = 7.68                     A18 300    3319
C AMAT(2,2) = -6.35                    A18 310    3320
C AMAT(2,3) = 8.90C                    A18 320    3321
C AMAT(2,4) = -1.02                    A18 330    3322
C AMAT(2,5) = 5.69C                    A18 340    3323
C AMAT(3,1) = 3.03C                    A18 350    3324
C AMAT(3,2) = -3.3E                    A18 360    3325
C AMAT(3,3) = -11.67                   A18 370    3326
C AMAT(3,4) = 4.19C                    A18 380    3327

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AMAT(3,5) = -3.60	A18	390	3328
AMAT(4,1) = -2.92	A18	400	3329
AMAT(4,2) = 5.67C	A18	410	3330
AMAT(4,3) = 8.323	A18	420	3331
AMAT(4,4) = 9.072	A18	430	3332
AMAT(4,5) = 0.0378	A18	440	3333
AMAT(5,1) = -.0578	A18	450	3334
AMAT(5,2) = 7.103	A18	460	3335
AMAT(5,3) = 9.992	A18	470	3336
AMAT(5,4) = 0.57E	A18	480	3337
AMAT(5,5) = 15.14	A18	490	3338
C	A18	500	3339
DO 1040 J=1,NOR	A18	510	3340
DO 1030 K=1,NJR	A18	520	3341
1030 BMAT(J,K)= AMAT(J,K)	A18	530	3342
1040 CONTINUE	A18	540	3343
C	A18	550	3344
CALL DMATIN(BMAT,NDR,DELTA)	A18	560	3345
C	A18	570	3346
DO 1070 K=1,NOR	A18	580	3347
DO 1060 J=1,NDR	A18	590	3348
CMAT(J,K)= 0.0	A18	600	3349
DO 1050 L=1,NOR	A18	610	3350
1050 CMAT(J,K)= CMAT(J,K) + AMAT(J,L)*BMAT(L,K)	A18	620	3351
1060 CONTINUE	A18	630	3352
1070 CONTINUE	A18	640	3353
C	A18	650	3354
CALL PAGE	A18	660	3355
WRITE (6,1020)((AMAT(J,K),J=1,NOR),K=1,NOR)	A18	670	3356
WRITE (6,1010)	A18	680	3357
WRITE (6,1020)((BMAT(J,K),J=1,NCR),K=1,NOR)	A18	690	3358
WRITE (6,1010)	A18	700	3359
WRITE (6,1020)((CMAT(J,K),J=1,NOR),K=1,NOR)	A18	710	3360
WRITE (6,1010)	A18	720	3361
WRITE (6,1010)	A18	730	3362
WRITE (6,1020)DELTA	A18	740	3363
STOP	A18	750	3364
END	A18	760	3365
V FOR B01,B01	B01	10	3366
C	B01	20	3367
C	B01	30	3368
C	B01	40	3369
C * MAIN ROUTINE WING /WING LIFT PROGRAM HADLOB/REVISED 15 MARCH 71	B01	50	3370
C	B01	60	3371
C * THEORY AND PROGRAM DEVELOPED BY ANTULIO V. GOMEZ, STAFF ENGINEER	B01	70	3372
C * TRW SYSTEMS GROUP, DIVISION OF TRW INC., HOUSTON, TEXAS - 77058	B01	80	3373
C * VERSION 2 ROUTINE (DOUBLE PRECISION-LANGLEY MATINV SUBROUTINE)	B01	90	3374
C	B01	100	3375
C * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72	B01	110	3376
C * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971	B01	120	3377
C	B01	130	3378
C	B01	140	3379
C	B01	150	3380
C	B01	160	3381
REAL MACHN(10)	B01	170	3382
DIMENSION COMMTS(42)	B01	180	3383
DIMENSION YSPAN(42)	B01	190	3384
DIMENSION WCL(21),ALFA(20),HEIGHT(10)	B01	200	3385
DIMENSION FLAPD(10),AILRND(2,10)	B01	210	3386
DIMENSION FLAPDJ(10),AILDJ(2,10)	B01	220	3387
C	B01	230	3388
COMMON/DATA00/NSTL ,ALFA0 ,CMAX ,ZHD ,FLAPDX,AILRDX(2)	B01	240	3389
* ,TITLE(14) ,STORE(14)	B01	250	3390
C	B01	260	3391
COMMON/DATA01/KIN ,KOUT ,KTL ,KT2 ,LINEX ,LINES	B01	270	3392
C	B01	280	3393
COMMON/DATA02/IFLG(15) ,EXECK(15) ,RAD ,PIE	B01	290	3394
C	B01	300	3395
COMMON/DATA03/NYS ,NCS ,XOCREF,X(10) ,Y(10) ,Z(10) ,E(10)	B01	310	3396
* ,C(10) ,ZOC(10) ,10) ,XOC(10)	B01	320	3397
C	B01	330	3398
COMMON/DATA04/YFLAP1,YFLAP2,FLAPC	B01	340	3399
* ,YAILRN,AILRNC,WSMOTH	B01	350	3400
C	B01	360	3401
COMMON/DATA06/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELTF1,DELTF2	B01	370	3402
* ,NOFLAP,NOAILR	B01	380	3403
C	B01	390	3404
COMMON/DATA07/LFLAP,LDRAG,CUTOF1,CUTOF2	B01	400	3405
C	B01	410	3406
EQUIVALENCE (LINX,LINEX),(NSS,NYS),(XOCR,XOCREF)	B01	420	3407
EQUIVALENCE (WFLAP1,YFLAP1),(WFLAP2,YFLAP2),(WFLAP3,YAILRN)	B01	430	3408
EQUIVALENCE (FLAPDJ,FLAPD),(AILDJ,AILRND)	B01	440	3409
C	B01	450	3410
C	B01	460	3411
NAMLIST/INPUT/ KOUT, KTL, KT2, KT3, LINX, COLOCP,	B01	470	3412
1 CUTOF1, CUTOF2, LFLAP, LDRAG, PMECF, DELALF,	B01	480	3413
2 NSS, NCS, X, Y, Z, E, C, XOC, ZOC, XOCR,	B01	490	3414
3 WFLAP1,WFLAP2,WFLAP3,FLAPC, WSMOTH, YSPAN,	B01	500	3415
4 NJOB, NJOBL, ALFA, MACHN, HEIGHT, FLAPDJ, AILDJ, WCL, CLEANF,	B01	510	3416
5 IFLG	B01	520	3417
C	B01	530	3418
DATA TEST/6H SENDJ/	B01	540	3419
DATA NJOB/17, NJOBL/20, ALFA/20*0.0/	B01	550	3420
DATA WCL/1.0, -0.4,-0.3,-0.2,-0.1,0.0,0.1,0.2,0.3,0.4,0.5,0.6,	B01	560	3421
* 0.8,0.9,1.0,1.1,1.2,1.3,1.4,1.5,1.6/	B01	570	3422
DATA MACHN/10*0.0/, HEIGHT/10*10000.0/	B01	580	3423
DATA AILRND/20*0.0/, FLAPD/10*0.0/	B01	590	3424
DATA PMECF/1.0/, COLOCP/0.75/, CLEANF/0.0035/, DELALF/1.0/	B01	600	3425
C	B01	610	3426
C	B01	620	3427
1000 FORMAT(13A6,4Z)	B01	630	3428
C	B01	640	3429
1010 FORMAT(/,15X,14H**** JOB TIME=,14,16H / ELAPSED TIME=,14,	B01	650	3430
1 1TH / NO,PLOT FILES=,14,35H / ISURF EXEC. VERSION 6-18-72 ****,			

2 //,15X,47(2H**1,/,15X,47(2H**1) )	801 660	3431
C	801 670	3432
1020 FORMAT(1H1,10X,35H**** JNBS INPUT LIST-CONTINUED ****,/,1X )	801 680	3433
1030 FORMAT(1X,13A6,A2)	801 690	3434
1040 FORMAT(1X,11H7 ACT ISURF)	801 700	3435
C	801 710	3436
1050 FORMAT(1H1,///,///,20X,	801 720	3437
1 53HSUBSONIC-FLUX LIFTING SURFACE ANALYSIS PROGRAM MA0108,/,/37X,	801 730	3438
2 36HTRW SYSTEMS INC., HOUSTON OPERATIONS,/,/44X,	801 740	3439
3 22HHOUSTON, TEXAS (77058),/,/16X,	801 750	3440
4 25H**** JNBS INPUT LIST ****,/, 1X )	801 760	3441
C	801 770	3442
C	801 780	3443
C	801 790	3444
XX	801 800	3445
C	801 810	3446
CALL BLKDAT	801 820	3447
REWIND KTI	801 830	3448
WRITE (KOUT,1050)	801 840	3449
WRITE (KOUT,1050)	801 850	3450
WRITE (KOUT,1040)	801 860	3451
LINES= 15	801 870	3452
1060 READ (KIN,1000)(STORE(I),I=1,14)	801 880	3453
WRITE (KTI,1000)(STORE(I),I=1,14)	801 890	3454
IF (LINEX-LINES) 1070,1080,1080	801 900	3455
1070 WRITE (KOUT,1020)	801 910	3456
LINES= 3	801 920	3457
1080 LINES= LINES+1	801 930	3458
WRITE (KOUT,1030)(STORE(I),I=1,14)	801 940	3459
C	801 950	3460
IF (STORE(1).NE.TEST) GO TO 1060	801 960	3461
END FILE KTI	801 970	3462
REWIND KTI	801 980	3463
WRITE (KOUT,1040)	801 990	3464
C	801 1000	3465
NCOMT=-1	801 1010	3466
NCALCP=-1	801 1020	3467
ISUM = 0.0	801 1030	3468
CALL RESET	801 1040	3469
C	801 1050	3470
C	801 1060	3471
1090 READ (KTI,1000)(TITLE(I),I=1,14)	801 1070	3472
IF (TITLE(1).EQ.TEST) CALL EXIT	801 1080	3473
IF (NCOMT) 1100,1100,1110	801 1090	3474
1100 READ (KTI,1000)(COMMTS(I),I=1,42)	801 1100	3475
1110 NCOMT= 1	801 1110	3476
READ (KTI,INPUT)	801 1120	3477
ALFAD= 1.0E+10	801 1130	3478
ZHO = 1.0E+10	801 1140	3479
EXECK(10)= CLEANF	801 1150	3480
EXECK(11)= COLOCP	801 1160	3481
EXECK(12)= DELALF	801 1170	3482
EXECK(13)= PMECF	801 1180	3483
IPLOTK= IFLG(12) + IFLG(13) + IFLG(14) - 1	801 1190	3484
C	801 1200	3485
IF (NCALCP) 1120,1120,1140	801 1210	3486
1120 NCALCP= 1	801 1220	3487
IF (IPLOTK) 1140,1130,1130	801 1230	3488
1130 REWIND KT2	801 1240	3489
IFLG(15)= 0	801 1250	3490
1140 CONTINUE	801 1260	3491
C	801 1270	3492
C	801 1280	3493
CALL PAGE	801 1290	3494
WRITE (KOUT,INPUT)	801 1300	3495
C	801 1310	3496
ITEST=70-(IFLG(6)*IFLG(3))/(12-IFLG(1))	801 1320	3497
IF (ITEST) 1150,1160,1160	801 1330	3498
1150 IFLG(3)= 70*(12-IFLG(1))/IFLG(6)	801 1340	3499
1160 IFLGX3= 21*(2/(IFLG(1)+1))	801 1350	3500
IF (IFLGX3-IFLG(3)) 1170,1180,1180	801 1360	3501
1170 IFLG(3)= IFLGX3	801 1370	3502
1180 CONTINUE	801 1380	3503
C	801 1390	3504
A1LRDX(1)= A1LRND(1,1) + A1LRND(1,2)	801 1400	3505
A1LRDX(2)= A1LRND(2,1) + A1LRND(2,2)	801 1410	3506
FLAPDX= FLAPD(1) + FLAPD(2)	801 1420	3507
C	801 1430	3508
NJAILR = 0	801 1440	3509
NDFLAP= 0	801 1450	3510
IFLG(1)= 0	801 1460	3511
UTEST= ABS( A1LRDX(1) - A1LRDX(2) ) - 0.5	801 1470	3512
C	801 1480	3513
IF (UTEST) 1200,1200,1190	801 1490	3514
1190 IFLG(1)= 1	801 1500	3515
NDAILP= 2	801 1510	3516
1200 IF (FLAPDX) 1210,1220,1210	801 1520	3517
1210 NDFLAP= 2	801 1530	3518
1220 NDFLPX= NJFLAP + NDAILP	801 1540	3519
IF (NDFLPX) 1290,1290,1230	801 1550	3520
1230 IF (IFLG(5)) 1240,1240,1250	801 1560	3521
1240 IFLG(5)= 1	801 1570	3522
1250 IF (IFLG(6)-1) 1260,1260,1270	801 1580	3523
1260 IFLG(6)= 2	801 1590	3524
1270 IF (IFLG(2)-5) 1290,1280,1280	801 1600	3525
1280 IFLG(2)= 4	801 1610	3526
1290 CONTINUE	801 1620	3527
C	801 1630	3528
A1LRDX(1)= 0.0	801 1640	3529
A1LRDX(2)= 0.0	801 1650	3530
FLAPDX= 0.0	801 1660	3531
NJNBX= NJORB+1	801 1670	3532
C	801 1680	3533
C	801 1690	3534
CALL LOFT(YSpan)	801 1700	3535
C	801 1710	3536

C	DO 1360 N=1,NJOB	B01 1720	3537
C	ALFAO= ALFA(N)	B01 1730	3538
C	HEIGT= HHEIGHT(N)	B01 1740	3539
C	ALFAO= ALFAO	B01 1750	3540
C	ZHO = HEIGT	B01 1760	3541
C	CMAX = 0.0	B01 1770	3542
C	EXECK(1)= 1.0	B01 1780	3543
C	IF (MACHN(N)-0.95) 1300,1300,1310	B01 1790	3544
C	CMAX = MACHN(N)	B01 1800	3545
1300	EXECK(1)= SQRT(1.0-CMAX**2)	B01 1810	3546
C	FLAPDX= FLAPD(N)	B01 1820	3547
1310	AILRDX(1)= AILRND(1,N)	B01 1830	3548
C	AILRDX(2)= AILRND(2,N)	B01 1840	3549
C	CALL OLIFT(ALFAO,HEIGT)	B01 1850	3550
C		B01 1860	3551
C		B01 1870	3552
C		B01 1880	3553
C		B01 1890	3554
C		B01 1900	3555
C	IF (IFLG(8)-1) 1330,1320,1320	B01 1910	3556
1320	CALL DLINERIALFAC,HEIGT,ALFA,MCL,NJOBX)	B01 1920	3557
1330	CONTINUE	B01 1930	3558
C		B01 1940	3559
C	CALL TIME(IMS)	B01 1950	3560
C	IS= IMS/1000	B01 1960	3561
C	ISJB= IS-ISUM	B01 1970	3562
C	ISUM= IS	B01 1980	3563
C		B01 1990	3564
C	LINES= LINES +6	B01 2000	3565
C	IF (LINEX-LINES) 1340,1350,1350	B01 2010	3566
1340	CALL PAGE	B01 2020	3567
1350	WRITE (KOUT,1010)ISJB,IS,IFLG(15)	B01 2030	3568
C	LINES= LINES + LINEX	B01 2040	3569
C		B01 2050	3570
1360	CONTINUE	B01 2060	3571
C		B01 2070	3572
C	GO TO 1090	B01 2080	3573
C		B01 2090	3574
C		B01 2100	3575
C	END	B01 2110	3576
V	FOR B02,B02	B02 10	3577
C		B02 20	3578
C		B02 30	3579
C		B02 40	3580
C	SUBROUTINE BLKDAT	B02 50	3581
C		B02 60	3582
C	* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B02 70		3583
C	* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B02 80		3584
C		B02 90	3585
C	XX	B02 100	3586
C		B02 110	3587
C	COMMON/DATA00/NSTL ,ALFAO ,CMAX ,ZHO ,FLAPDX,AILRDX(2)	B02 120	3588
C	* ,TITLE(14) ,STORE(14)	B02 130	3589
C		B02 140	3590
C	COMMON/DATA01/KIN ,KOUT ,KT1 ,KT2 ,LINEX ,LINES	B02 150	3591
C		B02 160	3592
C	COMMON/DATA02/IFLG(15) ,EXECK(15) ,RAD ,PIE	B02 170	3593
C		B02 180	3594
C	COMMON/DATA03/NYS ,NCS ,XOCREF,X(10) ,Y(10) ,Z(10) ,E(10)	B02 190	3595
C	* ,C(10) ,ZOC(10) ,XOC(10)	B02 200	3596
C		B02 210	3597
C	COMMON/DATA04/YFLAP1,YFLAP2,FLAPC	B02 220	3598
C	* ,YAILRN,AILRNC,WSMCTH	B02 230	3599
C		B02 240	3600
C	COMMON/DATA05/WINGD(15) ,FY(42,10) ,EC(42,10) ,ES(42,10)	B02 250	3601
C	* ,EYE(10) ,FLE(10) ,EYE(10) ,EHE(10) ,EC(42,10)	B02 260	3602
C	* ,EN(42,10,6) ,EV(42,10,6) ,VVINDX(42,10,3)	B02 270	3603
C		B02 280	3604
C	COMMON/DATA06/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELTF1,DELTF2	B02 290	3605
C	* ,NOFLAP,NOAILR	B02 300	3606
C		B02 310	3607
C	COMMON/DATA07/LFLAP,LORAG,CUTOF1,CUTOF2	B02 320	3608
C		B02 330	3609
C		B02 340	3610
C	DATA NSTU/1/, ALFAO/D.0/, CMAX/0.0/, ZHO/10000.0/,FLAPDX/0.0/,	B02 350	3611
C	* AILRDX/2*0.0/	B02 360	3612
C		B02 370	3613
C	DATA KIN/5/, KOUT/6/, KT1/1/, KT2/8/, LINEX/56/, LINES/0/	B02 380	3614
C		B02 390	3615
C	DATA IFLG/0,0,10,0,0,1,0,0,0,1,5*0/, EXECK/15*0.0/, RAD/57.29578/,	B02 400	3616
C	* PIE/3.14159/	B02 410	3617
C		B02 420	3618
C	DATA NYS/2/,NCS/2/,XOCREF/0.25/,X/10*0.0/,Y/0.0,100.0,8*1000.0/,	B02 430	3619
C	* Z/10*0.0/,F/10*0.0/,C/10*100.0/,ZOC/100*0.0/,XOC/0.0,1.0,8*0.0/	B02 440	3620
C		B02 450	3621
C	DATA YFLAP1/0.0/, YFLAP2/0.6/, FLAPC/0.3/, YAILRN/1.3/, AILRNC/.3/	B02 460	3622
C	* ,WSMCTH/0.20/	B02 470	3623
C		B02 480	3624
C	DATA LFLAP/0/, LORAG/0/, CUTOF1/0.0001/, CUTOF2/0.0029/	B02 490	3625
C		B02 500	3626
C	XX	B02 510	3627
C		B02 520	3628
C	RETURN	B02 530	3629
C		B02 540	3630
C	END	B02 550	3631
V	FOR B03,B03	B03 10	3632
C		B03 20	3633
C		B03 30	3634
C		B03 40	3635
C	SUBROUTINE LOFT(YSpan)	B03 50	3636

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C
C * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *R03 60 3637
C * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *R03 70 3638
C * *R03 80 3639
C *R03 90 3640
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXR03 100 3641
C DIMENSION X(10),XN(10),XC(10) R03 110 3642
C DIMENSION YSPAN(42) R03 120 3643
C DIMENSION COS1(3),COS2(3),COS3(3) R03 130 3644
C DIMENSION ZOCY(10) R03 140 3645
C R03 150 3646
C R03 160 3647
C COMMON/DATA01/KIN ,KOUT ,KT1 ,KT2 ,LINEX ,LINES R03 170 3648
C R03 180 3649
C COMMON/DATA02/IFLG(15) ,FXECK(15) ,RAO ,PIE R03 190 3650
C R03 200 3651
C COMMON/DATA03/NYS ,NCS ,XOCREF,X(10) ,Y(10) ,Z(10) ,E(10) R03 210 3652
C * ,C(10) ,ZOC(10,10) ,XOC(10) R03 220 3653
C R03 230 3654
C COMMON/DATA04/YFLAP1,YFLAP2,FLAPC R03 240 3655
C * ,YATLRN,AILRNC,WSMOTH R03 250 3656
C R03 260 3657
C COMMON/DATA05/WINGD(15) ,FY(42,10) ,EC(42,10) ,ES(42,10) R03 270 3658
C * ,EYF(10) ,ELE(10) ,EHE(10) ,FG(42,10) R03 280 3659
C * ,EN(42,10,6) ,EV(42,10,6) ,VVINDX(42,10,3) R03 290 3660
C R03 300 3661
C COMMON/DATA06/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELTF1,DELTF2 R03 310 3662
C * ,NOFLAP,NOAILR R03 320 3663
C R03 330 3664
C R03 340 3665
C 1000 FORMAT(1X,/,1X) R03 350 3666
C R03 360 3667
C 1010 FORMAT(53X,13HWING GEOMETRY,/,53X,13(1H*),/,/,1X, R03 370 3668
C 1 60H SPAN ROOT TIP ROOT TIP AREA , R03 380 3669
C 2 59H ASPECT MFAN MGC YBAR XBAR ZBAR,/, R03 390 3670
C 361H CHORD CHORD TWIST TWIST , R03 400 3671
C 4 60H RATIO CHORD (MGC) (MGC) (MGC) ,/R03 410 3672
C 5/,1X,3F10.3,2F10.4,F10.2,F10.4,5F10.3,/,/,1X, R03 420 3673
C 6 60H FLAP FLAP AILRN AILRN AILRN AILRN, R03 430 3674
C 7 60H DTHED SWEEP NO.SPAN NO.SPAN NO.SPAN NO.CHORD, R03 440 3675
C 861H SPAN1 SPAN2 CHORD SPAN1 SPAN2 CHORD, R03 450 3676
C 9 60H 1/4MGC 1/4MGC VORTICES DISCONT VORTICES DISCONT, R03 460 3677
C *,1X,2(2F10.3,F10.4),2F10.3,17,3(10.3,/,/,1X ) R03 470 3678
C R03 480 3679
C 1020 FORMAT(1X) R03 490 3680
C R03 500 3681
C 1030 FORMAT(1X, R03 510 3682
C 1 60H 2Y/H Y XLE X(1/4) XHE XTE , R03 520 3683
C 2 60H Z E SWEEP C/4 DTHED C CF , R03 530 3684
C 3/,1X) R03 540 3685
C 1040 FORMAT( 1X, 12F10.3 ) R03 550 3686
C R03 560 3687
C 1050 FORMAT(21X,50H XA(1)/C XA(2)/C XA(3)/C XA(4)/C XA(5)/C, R03 570 3688
C 1 50H XA(6)/C XA(7)/C XA(8)/C XA(9)/C XA(10)/C,/,/,21X, R03 580 3689
C 2 10F10.4,/,/,1X, 40H Y 2Y/H , ZA(1)/C, ZA(2)/C, R03 590 3690
C 3 60H ZA(3)/C ZA(4)/C ZA(5)/C ZA(6)/C ZA(7)/C ZA(8)/C, R03 600 3691
C 4 20H ZA(9)/C ZA(10)/C,/,1X ) R03 610 3692
C 1060 FORMAT( 1X,12F10.4 ) R03 620 3693
C R03 630 3694
C 1070 FORMAT(3X,1HJ,2X,1HK,5X,1HY,9X,2HDY,8X,2HDC,8X,2HDS,/,1X ) R03 640 3695
C 1080 FORMAT(1X,2I3,12(1PE10.3) ) R03 650 3696
C R03 660 3697
C 1090 FORMAT(3X,1HJ,2X,1HK,5X,2HXV,8X,2HYV,8X,2HZV,8X,3H1XV,7X,3H1YV,7X, R03 670 3698
C * 3H1ZV,7X,2HXN,8X,2HYN,8X,2HZN,8X,3H1KN,7X,3H1YN,7X,3H1ZN,/,1X) R03 680 3699
C 1100 FORMAT( 1X, 2I3, 12(1PE10.3) ) R03 690 3700
C R03 700 3701
C 1110 FORMAT(5X,1HB,9X,2HCR,8X,2HCT,8X,2HFR,8X,2HET,8X,1HS,9X,2HAR,8X, R03 710 3702
C * 2HMC,8X,3HMG,6X,4HMG,6X,4HMG,6X,4HMG,/,1X) R03 720 3703
C 1120 FORMAT(1X,12F10.2 ) R03 730 3704
C R03 740 3705
C 1130 FORMAT(1X,/,1X,14H(EOF PLOT FILE,13,1H) ) R03 750 3706
C R03 760 3707
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXR03 770 3708
C R03 780 3709
C R03 790 3710
C R03 800 3711
C * FILL IN NYS + 1 SPACE * R03 810 3712
C R03 820 3713
C SPAN= 2.0*YINYS R03 830 3714
C WINGDI 1= SPAN R03 840 3715
C WINGDI 2= C(1) R03 850 3716
C WINGDI 3= C(NYS) R03 860 3717
C WINGDI 4= E(1) R03 870 3718
C WINGDI 5= E(NYS) R03 880 3719
C R03 890 3720
C BOTU= SPAN/2.0 R03 900 3721
C DELTF1= WSMOTH R03 910 3722
C DELTF2= WSMOTH R03 920 3723
C R03 930 3724
C IF (WSMOTH-1.0) 1140,1150,1150 R03 940 3725
C 1140 DELTF1= BOTU*DELTF1 R03 950 3726
C DELTF2= BOTU*DELTF2 R03 960 3727
C 1150 CONTINUE R03 970 3728
C R03 980 3729
C YFF11 = YFLAP1 R03 990 3730
C YFF21 = YFLAP2 R03 1000 3731
C YFF31 = YATLRN R03 1010 3732
C R03 1020 3733
C IF (YFLAP2-1.01) 1160,1170,1170 R03 1030 3734
C 1160 YFF11 = YFF11*BOTU R03 1040 3735
C YFF21 = YFF21*BOTU R03 1050 3736
C YFF31 = YFF31*BOTU R03 1060 3737
C 1170 YFF11 = YFF11 - 0.5*DELTF1 R03 1070 3738
C YFF21 = YFF21 - 0.5*DELTF2 R03 1080 3739
C YFF31 = YFF31 - 0.5*DELTF2 R03 1090 3740
C R03 1100 3741
C YFF12= YFF11 + DELTF1 R03 1110 3742

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YFF22= YFF21 + DELTF2
YFF32 = YFF31 + DELTF2
C
NY1= NYS-1
NY2= NYS+1
Y(NY2)= Y(NYS) + 0.20*(Y(NYS)-Y(NY1))
RAT=(Y(NY2)-Y(NY1))/(Y(NYS)-Y(NY1))
X(NY2)= X(NYS) + RAT*(X(NYS) - X(NY1))
Z(NY2)= Z(NYS) + RAT*(Z(NYS) - Z(NY1))
E(NY2)= E(NYS) + RAT*(E(NYS) - E(NY1))
C(NY2)= C(NYS) + RAT*(C(NYS) - C(NY1))
DO 1180 L=1,NCS
1180 ZOC(L,NY2)= ZOC(L,NYS) + RAT*(ZOC(L,NYS) - ZOC(L,NY1))
C
L= NCS
L1= L-1
L2= L+1
NCSPI= L2
XOC(L2)= XOC(L) + 0.10*(XOC(L)-XOC(L1))
RAT= (XOC(L2)-XOC(L))/(XOC(L)-XOC(L1))
DO 1190 N=1,NY2
1190 ZOC(L2,N)= ZOC(L,N) + RAT*(ZOC(L,N)-ZOC(L1,N))
C
C
C * CALCULATE SPAN FUNCTIONS *
C
NSPV= IFLG(3)
NSPS= NSPV + 1
NDIS= IFLG(2)
IFLAG= IFLG(4)
C
CALL SPANI(IFLAG,NSPS,NDIS,SPAN, YSPAN)
C
DO 1220 L=1,NY2
EYE(L)= Y(L)
ELE(L)= X(L) - XOCREF*C(L)
ETE(L)= ELE(L) + C(L)
CF = FLAPC
IF (FLAPC-0.8) 1200,1200,1210
1200 CF = CF*C(L)
1210 EHE(L)= ETE(L) - CF
1220 CONTINUE
C
C
C
C * CALCULATE CHORD FUNCTIONS *
C
IFLAG= IFLG(7)
NCV = IFLG(6)
NDIS = IFLG(5)
NOFLPX = NOFLAP + NOAILR
C
IF (NOFLPX) 1240,1240,1230
1230 NCV = NCV -1
NDIS= NDIS-1
1240 CONTINUE
C
CALL CHORDI(IFLAG,NCV,NDIS, XV,XN,XC)
C
DO 1280 J=1,NSPS
C
YF= YSPAN(J)
C
CALL CHORDT(YF,XLE,XC04,XTE,XHE,CW,CF)
C
IF (NOFLPX) 1260,1260,1250
1250 CW= CW-CF
1260 CONTINUE
C
DO 1270 L=1,NCV
EC(J,L)= XLE + XC(L)*CW
EY(J,L)= YF
EV(J,L,1)= XLE + XV(L)*CW
EV(J,L,2)= YF
EV(J,L,3)= 0.0
EN(J,L,1)= XLE + XN(L)*CW
EN(J,L,2)= YF
1270 EN(J,L,3)= 0.0
C
1280 CONTINUE
C
C
C IF (NOFLPX) 1310,1310,1290
1290 CONTINUE
C
NCV= NCV + 1
C
DO 1300 J=1,NSPS
YF= YSPAN(J)
C
CALL CHORDT(YF,XLE,XC04,XTE,XHE,CW,CF)
C
EY(J,NCV)= YF
EC(J,NCV)= XTE
EV(J,NCV,1)= XHE + 0.25*CF
EV(J,NCV,2)= YF
EV(J,NCV,3)= 0.0
EN(J,NCV,1)= XHE + 0.75*CF
EN(J,NCV,2)= YF
1300 EN(J,NCV,3)= 0.0
C
1310 CONTINUE
C
C
C

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803 1120 3743
803 1130 3744
803 1140 3745
803 1150 3746
803 1160 3747
803 1170 3748
803 1180 3749
803 1190 3750
803 1200 3751
803 1210 3752
803 1220 3753
803 1230 3754
803 1240 3755
803 1250 3756
803 1260 3757
803 1270 3758
803 1280 3759
803 1290 3760
803 1300 3761
803 1310 3762
803 1320 3763
803 1330 3764
803 1340 3765
803 1350 3766
803 1360 3767
803 1370 3768
803 1380 3769
803 1390 3770
803 1400 3771
803 1410 3772
803 1420 3773
803 1430 3774
803 1440 3775
803 1450 3776
803 1460 3777
803 1470 3778
803 1480 3779
803 1490 3780
803 1500 3781
803 1510 3782
803 1520 3783
803 1530 3784
803 1540 3785
803 1550 3786
803 1560 3787
803 1570 3788
803 1580 3789
803 1590 3790
803 1600 3791
803 1610 3792
803 1620 3793
803 1630 3794
803 1640 3795
803 1650 3796
803 1660 3797
803 1670 3798
803 1680 3799
803 1690 3800
803 1700 3801
803 1710 3802
803 1720 3803
803 1730 3804
803 1740 3805
803 1750 3806
803 1760 3807
803 1770 3808
803 1780 3809
803 1790 3810
803 1800 3811
803 1810 3812
803 1820 3813
803 1830 3814
803 1840 3815
803 1850 3816
803 1860 3817
803 1870 3818
803 1880 3819
803 1890 3820
803 1900 3821
803 1910 3822
803 1920 3823
803 1930 3824
803 1940 3825
803 1950 3826
803 1960 3827
803 1970 3828
803 1980 3829
803 1990 3830
803 2000 3831
803 2010 3832
803 2020 3833
803 2030 3834
803 2040 3835
803 2050 3836
803 2060 3837
803 2070 3838
803 2080 3839
803 2090 3840
803 2100 3841
803 2110 3842
803 2120 3843
803 2130 3844
803 2140 3845
803 2150 3846
803 2160 3847
803 2170 3848

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C	NCVP1 = NCV + 1	R03 2180	3849
C	DO 1370 J=1,NSPS	R03 2190	3850
	J2= J+1	R03 2200	3851
	YF= YSPAN(J)	R03 2210	3852
C	CALL CHORDT(YF,XLE,XC04,XTE,XHE,CW,CF)	R03 2220	3853
C		R03 2230	3854
	IF (J-NSPS) 1320,1340,1340	R03 2240	3855
1320	CONTINUE	R03 2250	3856
	DO 1330 K=1,NCV	R03 2260	3857
1330	EY(J,K)= EY(J2,K)-EY(J,K)	R03 2270	3858
1340	CONTINUE	R03 2280	3859
C		R03 2290	3860
	EY(J,NCVP1,1) = XTE	R03 2300	3861
	EY(J,NCVP1,2) = YF	R03 2310	3862
	EY(J,NCVP1,3) = 0.0	R03 2320	3863
	EC(J,NCVP1) = 0.0	R03 2330	3864
C		R03 2340	3865
	DO 1350 K=1,NCV	R03 2350	3866
1350	EC(J,K)= EC(J,K)-XLE	R03 2360	3867
	DO 1360 L=2,NCV	R03 2370	3868
	K= NCV + 2 - L	R03 2380	3869
	K1= K-1	R03 2390	3870
1360	FC(J,K)= EC(J,K)-EC(J,K1)	R03 2400	3871
C		R03 2410	3872
1370	CONTINUE	R03 2420	3873
C		R03 2430	3874
C		R03 2440	3875
C		R03 2450	3876
	DO 1390 J=1,NSPV	R03 2460	3877
	J2= J+1	R03 2470	3878
	DO 1380 K=1,NCV	R03 2480	3879
	EC(J,K)= 0.5*(EC(J,K)+EC(J2,K))	R03 2490	3880
1380	ES(J,K)= EC(J,K)*EY(J,K)	R03 2500	3881
1390	CONTINUE	R03 2510	3882
C		R03 2520	3883
C		R03 2530	3884
C		R03 2540	3885
C		R03 2550	3886
C	* CALCULATE AIRFOIL SECTION CAMBER *	R03 2560	3887
C	* CALCULATE GEOMETRIC TWIST *	R03 2570	3888
C		R03 2580	3889
	DO 1580 J=1,NSPS	R03 2590	3890
C		R03 2600	3891
	YF= YSPAN(J)	R03 2610	3892
	YA= ABS(YF)	R03 2620	3893
C		R03 2630	3894
	M= -1	R03 2640	3895
	DO 1420 L=2,NYZ	R03 2650	3896
	IF (M) 1400,1400,1420	R03 2660	3897
1400	TEST= YA - Y(L)	R03 2670	3898
	IF (TEST) 1410,1410,1420	R03 2680	3899
1410	M= L	R03 2690	3900
1420	CONTINUE	R03 2700	3901
	M1= M-1	R03 2710	3902
	IF (M1) 1430,1430,1440	R03 2720	3903
1430	M1= 1	R03 2730	3904
	M= 2	R03 2740	3905
1440	RAT= (YA-Y(M1))/(Y(M1)-Y(M))	R03 2750	3906
C		R03 2760	3907
	TANEPS= E(M1) + RAT*( E(M)-E(M1) )	R03 2770	3908
	TANEPS= TAN(TANEPS/RAD)	R03 2780	3909
	DELTAZ= Z(M1) + RAT*( Z(M)-Z(M1) )	R03 2790	3910
C		R03 2800	3911
	DO 1450 L=1,NCSP1	R03 2810	3912
1450	ZOCY(L)= ZOC(L,M1) + RAT*( ZOC(L,M) - ZOC(L,M1) )	R03 2820	3913
C		R03 2830	3914
	CALL CHORDT(YF,XLE,XC04,XTE,XHE,CW,CF)	R03 2840	3915
C		R03 2850	3916
	XROTAT= XLE + XCOCREF*CW	R03 2860	3917
C		R03 2870	3918
C		R03 2880	3919
	DO 1560 K=1,NCV	R03 2890	3920
C		R03 2900	3921
	N=-1	R03 2910	3922
	XTEST= EY(J,K,1) - XLE	R03 2920	3923
	DO 1480 L=2,NCSP1	R03 2930	3924
	IF (N) 1460,1460,1480	R03 2940	3925
1460	TEST= XTEST - XOC(L)*CW	R03 2950	3926
	IF (TEST) 1470,1470,1480	R03 2960	3927
1470	N= L	R03 2970	3928
	N1= L-1	R03 2980	3929
1480	CONTINUE	R03 2990	3930
	IF (N1) 1490,1490,1500	R03 3000	3931
1490	N1= 1	R03 3010	3932
	N= 2	R03 3020	3933
1500	RATS= (XTEST-CW*XOC(N1))/(XOC(N)-XOC(N1))	R03 3030	3934
	EY(J,K,3)= DELTAZ + CW*ZOCY(N1) + (ZOCY(N)-ZOCY(N1))*RATS	R03 3040	3935
C		R03 3050	3936
	N=-1	R03 3060	3937
	XTEST= EY(J,K,1) - XLE	R03 3070	3938
	DO 1530 L=2,NCSP1	R03 3080	3939
	IF (N) 1510,1510,1530	R03 3090	3940
1510	TEST= XTEST - XOC(L)*CW	R03 3100	3941
	IF (TEST) 1520,1520,1530	R03 3110	3942
1520	N= L	R03 3120	3943
	N1= L-1	R03 3130	3944
1530	CONTINUE	R03 3140	3945
	IF (N1) 1540,1540,1550	R03 3150	3946
1540	N1= 1	R03 3160	3947
	N= 2	R03 3170	3948
1550	RATS= (XTEST-CW*XOC(N1))/(XOC(N)-XOC(N1))	R03 3180	3949
	EY(J,K,3)= DELTAZ + CW*ZOCY(N1) + (ZOCY(N)-ZOCY(N1))*RATS	R03 3190	3950
C		R03 3200	3951
1560	CONTINUE	R03 3210	3952
C		R03 3220	3953
C		R03 3230	3954

DO 1570 K=1,NCV	803 3240	3955
EV(J,K,3)= EV(J,K,3) + (EV(J,K,1)-XROTAT)*TANEPS	803 3250	3956
1570 EN(J,K,3)= EN(J,K,3) + (EN(J,K,1)-XROTAT)*TANEPS	803 3260	3957
C	803 3270	3958
1580 CONTINUE	803 3280	3959
C	803 3290	3960
C	803 3300	3961
C	803 3310	3962
C * CALCULATE UNIT VECTORS *	803 3320	3963
C	803 3330	3964
DO 1640 J=1,NSPV	803 3340	3965
J2= J+1	803 3350	3966
C	803 3360	3967
DO 1630 K=1,NCV	803 3370	3968
C	803 3380	3969
SUM1= 0.0	803 3390	3970
SUM2= 0.0	803 3400	3971
DO 1590 L=1,3	803 3410	3972
M= L+3	803 3420	3973
EN(J,K,L)= 0.5*( EN(J2,K,L) + EN(J,K,L) )	803 3430	3974
RAT = 0.5*( EV(J2,K,L) + EV(J,K,L) )	803 3440	3975
EV(J,K,M)= EV(J2,K,L) - EV(J,K,L)	803 3450	3976
EN(J,K,M)= RAT - EN(J,K,L)	803 3460	3977
SUM1= SUM1 + EV(J,K,M)**2	803 3470	3978
1590 SUM2= SUM2 + EN(J,K,M)**2	803 3480	3979
SUM1= SQRT( SUM1 )	803 3490	3980
SUM2= SQRT( SUM2 )	803 3500	3981
DO 1600 L=L+3	803 3510	3982
M= L+3	803 3520	3983
EV(J,K,M)= EV(J,K,M)/SUM1	803 3530	3984
EN(J,K,M)= EN(J,K,M)/SUM2	803 3540	3985
COS1(L)= EN(J,K,M)	803 3550	3986
1600 COS2(L)= -EV(J,K,M)	803 3560	3987
C	803 3570	3988
CALL CROSP(COS1,COS2,COS3)	803 3580	3989
C	803 3590	3990
SUM1= 0.0	803 3600	3991
DO 1610 L=1,3	803 3610	3992
1610 SUM1= SUM1 + COS3(L)**2	803 3620	3993
SUM1= SQRT( SUM1 )	803 3630	3994
DO 1620 L=L+3	803 3640	3995
M= L+3	803 3650	3996
1620 EN(J,K,M)= COS3(L)/SUM1	803 3660	3997
C	803 3670	3998
1630 CONTINUE	803 3680	3999
C	803 3690	4000
1640 CONTINUE	803 3700	4001
C	803 3710	4002
C	803 3720	4003
C	803 3730	4004
C * WING DATA *	803 3740	4005
C	803 3750	4006
C WINGD( 1 ) = SPAN	803 3760	4007
C WINGD( 2 ) = ROOT CHORD	803 3770	4008
C WINGD( 3 ) = TIP CHORD	803 3780	4009
C WINGD( 4 ) = ROOT GEOMETRIC TWIST	803 3790	4010
C WINGD( 5 ) = TIP GEOMETRIC TWIST	803 3800	4011
C WINGD( 6 ) = AREA	803 3810	4012
C WINGD( 7 ) = ASPECT RATIO	803 3820	4013
C WINGD( 8 ) = MEAN CHORD	803 3830	4014
C WINGD( 9 ) = MEAN GEOMETRIC CHORD	803 3840	4015
C WINGD(10) = SPAN LOCATION OF MEAN GEOMETRIC CHORD	803 3850	4016
C WINGD(11) = XMGC, HORIZONTAL MOMENT ARM TO 1/4 CHORD OF MGC	803 3860	4017
C WINGD(12) = ZMGC, VERTICAL MOMENT ARM TO 1/4 CHORD OF MGC	803 3870	4018
C WINGD(14) = SWEEP ANGLE OF 1/4 MGC	803 3880	4019
C	803 3890	4020
C	803 3900	4021
DO 1570 K=1,NCV	803 3910	4022
EV(J,K,3)= EV(J,K,3) + (EV(J,K,1)-XROTAT)*TANEPS	803 3920	4023
1570 EN(J,K,3)= EN(J,K,3) + (EN(J,K,1)-XROTAT)*TANEPS	803 3930	4024
C	803 3940	4025
1580 CONTINUE	803 3950	4026
C	803 3960	4027
C	803 3970	4028
C	803 3980	4029
C * CALCULATE UNIT VECTORS *	803 3990	4030
C	803 4000	4031
DO 1640 J=1,NSPV	803 4010	4032
J2= J+1	803 4020	4033
C	803 4030	4034
DO 1630 K=1,NCV	803 4040	4035
C	803 4050	4036
SUM1= 0.0	803 4060	4037
SUM2= 0.0	803 4070	4038
DO 1590 L=1,3	803 4080	4039
M= L+3	803 4090	4040
EN(J,K,L)= 0.5*( EN(J2,K,L) + EN(J,K,L) )	803 4100	4041
RAT = 0.5*( EV(J2,K,L) + EV(J,K,L) )	803 4110	4042
EV(J,K,M)= EV(J2,K,L) - EV(J,K,L)	803 4120	4043
EN(J,K,M)= RAT - EN(J,K,L)	803 4130	4044
SUM1= SUM1 + EV(J,K,M)**2	803 4140	4045
1590 SUM2= SUM2 + EN(J,K,M)**2	803 4150	4046
SUM1= SQRT( SUM1 )	803 4160	4047
SUM2= SQRT( SUM2 )	803 4170	4048
DO 1600 L=L+3	803 4180	4049
M= L+3	803 4190	4050
EV(J,K,M)= EV(J,K,M)/SUM1	803 4200	4051
EN(J,K,M)= EN(J,K,M)/SUM2	803 4210	4052
COS1(L)= EN(J,K,M)	803 4220	4053
1600 COS2(L)= -EV(J,K,M)	803 4230	4054
C	803 4240	4055
CALL CROSP(COS1,COS2,COS3)	803 4250	4056
C	803 4260	4057
SUM1= 0.0	803 4270	4058
DO 1610 L=1,3	803 4280	4059
1610 SUM1= SUM1 + COS3(L)**2	803 4290	4060

SUM1= SQRT( SUM1 )	803 4300	4061
DO 1620 L=1,3	803 4310	4062
M= L+3	803 4320	4063
1620 EN(J,K,M)= COS3(L)/SUM1	803 4330	4064
C	803 4340	4065
1630 CONTINUE	803 4350	4066
C	803 4360	4067
1640 CONTINUE	803 4370	4068
C	803 4380	4069
C	803 4390	4070
C	803 4400	4071
C	803 4410	4072
C * WING DATA *	803 4420	4073
C	803 4430	4074
C WINGD( 1) = SPAN	803 4440	4075
C WINGD( 2) = ROOT CHORD	803 4450	4076
C WINGD( 3) = TIP CHORD	803 4460	4077
C WINGD( 4) = ROOT GEOMETRIC TWIST	803 4470	4078
C WINGD( 5) = TIP GEOMETRIC TWIST	803 4480	4079
C WINGD( 6) = AREA	803 4490	4080
C WINGD( 7) = ASPECT RATIO	803 4500	4081
C WINGD( 8) = MEAN CHORD	803 4510	4082
C WINGD( 9) = MEAN GEOMETRIC CHORD	803 4520	4083
C WINGD(10) = SPAN LOCATION OF MEAN GEOMETRIC CHORD	803 4530	4084
C WINGD(11) = XMGC, HORIZONTAL MOMENT ARM TO 1/4 CHORD OF MGC	803 4540	4085
C WINGD(12) = ZMGC, VERTICAL MOMENT ARM TO 1/4 CHORD OF MGC	803 4550	4086
C WINGD(14) = SWEEP ANGLE OF 1/4 MGC	803 4560	4087
C WINGD(15) = FLAP CHORD	803 4570	4088
C	803 4580	4089
SUM1 = 0.0	803 4590	4090
SUM6 = 0.0	803 4600	4091
SUM8 = 0.0	803 4610	4092
SUM9 = 0.0	803 4620	4093
SUM10 = 0.0	803 4630	4094
SUM11 = 0.0	803 4640	4095
SUM12 = 0.0	803 4650	4096
C	803 4660	4097
OSPAN= SPAN/200.0	803 4670	4098
C	803 4680	4099
DO 1720 J=1,101	803 4690	4100
C	803 4700	4101
JM= J-1	803 4710	4102
YA2= DSPAN*FLOAT(JM)	803 4720	4103
C	803 4730	4104
CALL CHORDT(YA2,XLE,XMGC2,XTE,XHE,CW2,C F)	803 4740	4105
C	803 4750	4106
M=-1	803 4760	4107
DO 1670 L=2,NV2	803 4770	4108
IF (M) 1650,1650,1670	803 4780	4109
1650 TEST= YA2-Y(L)-0.0001	803 4790	4110
IF (TEST) 1660,1660,1670	803 4800	4111
1660 M=L	803 4810	4112
M1= L-1	803 4820	4113
1670 CONTINUE	803 4830	4114
IF (M1) 1680,1690,1690	803 4840	4115
1680 M1= 1	803 4850	4116
M = 2	803 4860	4117
1690 RAT= (YA2-Y(M1))/(Y(M)-Y(M1))	803 4870	4118
C	803 4880	4119
TANFPS= F(M1)+(F(M)-F(M1))*RAT	803 4890	4120
DELTAZ= Z(M1)+(Z(M)-Z(M1))*RAT	803 4900	4121
DELTA2= DELTAZ + (XMGC2-XLE-XOC REF*CW2)*TANITANEPS/RAD1	803 4910	4122
C	803 4920	4123
IF (JM) 1710,1710,1700	803 4930	4124
C	803 4940	4125
1700 CW = 0.5*(CW2+C*1)	803 4950	4126
AREA= CW*OSPAN	803 4960	4127
SUM1 = SUM1 + OSPAN	803 4970	4128
SUM6 = SUM6 + AREA	803 4980	4129
SUM8 = SUM8 + AREA	803 4990	4130
SUM9 = SUM9 + AREA*CW	803 5000	4131
SUM10 = SUM10 + AREA*(YA2+YA1)*0.5	803 5010	4132
SUM11 = SUM11 + AREA*(XMGC2+XMGC1)*0.5	803 5020	4133
SUM12 = SUM12 + AREA*(DELTA2+DELTA1)*0.5	803 5030	4134
C	803 5040	4135
1710 DELTA1= DELTA2	803 5050	4136
XMGC1= XMGC2	803 5060	4137
CW1 = CW2	803 5070	4138
YA1 = YA2	803 5080	4139
C	803 5090	4140
1720 CONTINUE	803 5100	4141
C	803 5110	4142
C	803 5120	4143
ZERO = 0.0	803 5130	4144
C	803 5140	4145
CALL CHORDT(ZERO,XLE,XC04,XTE,XHE,CW,CF)	803 5150	4146
C	803 5160	4147
XROOT= XC04	803 5170	4148
ZROOT= Z(L)	803 5180	4149
C	803 5190	4150
WINGD( 1) = SUM1*2.0	803 5200	4151
WINGD( 6) = SUM6*2.0	803 5210	4152
WINGD( 7) = 2.0*(SUM1**2)/SUM6	803 5220	4153
WINGD( 8) = SUM8/SUM1	803 5230	4154
WINGD( 9) = SUM9/SUM6	803 5240	4155
WINGD(10) = SUM10/SUM6	803 5250	4156
WINGD(11) = SUM11/SUM6	803 5260	4157
WINGD(12) = SUM12/SUM6	803 5270	4158
WINGD(13) = RAD*ATAN((WINGD(12)- ZROOT)/WINGD(10))	803 5280	4159
WINGD(14) = RAD*ATAN((WINGD(11)- XROOT)/WINGD(10))	803 5290	4160
WINGD(15) = FLAPC	803 5300	4161
C	803 5310	4162
C	803 5320	4163
CALL PAGE	803 5330	4164
WRITE (KOUT,1010)(WINGD(I),I=1,12),YFLAP1,YFLAP2,FLAPC,YFLAP2,BOTU	803 5340	4165
1,FLAPC,WINGD(13),WINGD(14),IFLG(3),IFLG(2),IFLG(5),IFLG(5)	803 5350	4166



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      LINES= LINES + 15
C
C      WRITE (KOUT,1030)
      LINES= LINES + 3
C
      DO 1820 J=1,NSPS
C
      YF= YSPAN(J)
      YA= ABS(YF)
      YOB= YF/ROTU
C
      CALL CHORDT(YF,XLE,XCO4,XTE,XHE,CW,CF)
C
      M= -1
      DO 1750 L=2,NY2
      IF (M) 1730,1730,1750
1730 TEST= YA - Y(L) - 0.0001
      IF (TEST) 1740,1740,1750
1740 M= L
      M1= M-1
1750 CONTINUE
      IF (M1) 1760,1760,1770
1760 M= 2
      M1= 1
1770 RAT= (YA-Y(M1))/(Y(M)-Y(M1))
C
      ZY= Z(M1) + RAT*( Z(M) - Z(M1) )
      EK= E(M1) + RAT*( E(M) - E(M1) )
C
      IF (J-1) 1780,1780,1790
1780 YF1= YF - 0.05*SPAN/FLOAT(NSPV)
      YA= ABS(YF1)
C
      CALL CHORDT(YA,XLE1,XCO41,XTE1,XHE1,CW1,CF1)
      ZY1= Z(M1) + (Z(M)-Z(M1))*(YA-Y(M1))/(Y(M)-Y(M1))
C
1790 DELTA1= YF-YF1
C
      BETA= RAD*ATAN( (XCO4-XCO41)/DELTA1)
      DIME= RAD*ATAN( (ZY-ZY1)/DELTA1 )
C
      IF (LINEX-LINES) 1800,1810,1810
1800 CALL PAGE
      WRITE (KOUT,1030)
      LINES= LINES+2
1810 WRITE (KOUT,1040)YOB,YF,XLE,XCO4,XHE,XTE,ZY,EK,BETA,DIME,CW,CF
C
      LINES= LINES + 1
      YF1= YF
      ZY1= ZY
      XCO41= XCO4
1820 CONTINUE
C
C      WRITE (KOUT,1000)
      LINES= LINES + 3
      LINES= LINES + 7
      IF (LINEX-LINES) 1830,1840,1840
1830 CALL PAGE
      LINES= LINES + 7
1840 WRITE (KOUT,1050)(XOC(I),I=1,10)
      LINES= LINES + 1
C
      DO 1870 J=1,NYS
      IF (LINEX-LINES) 1850,1860,1860
1850 CALL PAGE
      WRITE (KOUT,1050)
      LINES= LINES+7
1860 CONTINUE
      YOB= Y(J)/BOTU
      WRITE (KOUT,1060)Y(J),YOB,(ZOC(I,J),I=1,NCS)
      LINES= LINES + 1
1870 CONTINUE
C
      LINES= LINES+3
      IF (LINEX-LINES) 1880,1890,1890
1880 CALL PAGE
      LINES= LINES + 3
1890 WRITE (KOUT,1000)
C
C
C      * DEBUG OUTPUT *
C
      IF (IFLG(10)) 2030,1900,1900
1900 IFLG(10)= IFLG(10)-1
C
C
      LINES= LINES+2
      IF (LINEX-LINES) 1910,1920,1920
1910 CALL PAGE
      LINES= LINES+2
1920 WRITE (KOUT,1070)
C
      DO 1950 K=1,NCV
      LINES= LINES+1
      DO 1940 J=1,NSPV
      LINES= LINES+1
      IF (LINEX-LINES) 1930,1940,1940
1930 CALL PAGE
      WRITE (KOUT,1070)
      LINES= LINES + 2+1
1940 WRITE (KOUT,1080)J,K,EN(J,K,2),EY(J,K),EC(J,K),ES(J,K)
1950 WRITE (KOUT,1020)
C

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803	5360	4167
803	5370	4168
803	5380	4169
803	5390	4170
803	5400	4171
803	5410	4172
803	5420	4173
803	5430	4174
803	5440	4175
803	5450	4176
803	5460	4177
803	5470	4178
803	5480	4179
803	5490	4180
803	5500	4181
803	5510	4182
803	5520	4183
803	5530	4184
803	5540	4185
803	5550	4186
803	5560	4187
803	5570	4188
803	5580	4189
803	5590	4190
803	5600	4191
803	5610	4192
803	5620	4193
803	5630	4194
803	5640	4195
803	5650	4196
803	5660	4197
803	5670	4198
803	5680	4199
803	5690	4200
803	5700	4201
803	5710	4202
803	5720	4203
803	5730	4204
803	5740	4205
803	5750	4206
803	5760	4207
803	5770	4208
803	5780	4209
803	5790	4210
803	5800	4211
803	5810	4212
803	5820	4213
803	5830	4214
803	5840	4215
803	5850	4216
803	5860	4217
803	5870	4218
803	5880	4219
803	5890	4220
803	5900	4221
803	5910	4222
803	5920	4223
803	5930	4224
803	5940	4225
803	5950	4226
803	5960	4227
803	5970	4228
803	5980	4229
803	5990	4230
803	6000	4231
803	6010	4232
803	6020	4233
803	6030	4234
803	6040	4235
803	6050	4236
803	6060	4237
803	6070	4238
803	6080	4239
803	6090	4240
803	6100	4241
803	6110	4242
803	6120	4243
803	6130	4244
803	6140	4245
803	6150	4246
803	6160	4247
803	6170	4248
803	6180	4249
803	6190	4250
803	6200	4251
803	6210	4252
803	6220	4253
803	6230	4254
803	6240	4255
803	6250	4256
803	6260	4257
803	6270	4258
803	6280	4259
803	6290	4260
803	6300	4261
803	6310	4262
803	6320	4263
803	6330	4264
803	6340	4265
803	6350	4266
803	6360	4267
803	6370	4268
803	6380	4269
803	6390	4270
803	6400	4271
803	6410	4272

LINES= LINES+3	803 6420	4273
IF (LINEX-LINES) 1960,1970,1970	803 6430	4274
1960 CALL PAGE	803 6440	4275
LINES= LINES+3	803 6450	4276
1970 WRITE (KOUT,1000)	803 6460	4277
C	803 6470	4278
IF (LINEX-LINES) 1980,1990,1990	803 6480	4279
1980 CALL PAGE	803 6490	4280
LINES= LINES + 2	803 6500	4281
1990 WRITE (KOUT,1090)	803 6510	4282
C	803 6520	4283
DO 2020 K=1,NCV	803 6530	4284
LINES= LINES+1	803 6540	4285
DO 2010 J=1,NSPV	803 6550	4286
LINES= LINES+1	803 6560	4287
IF (LINEX-LINES) 2000,2010,2010	803 6570	4288
2000 CALL PAGE	803 6580	4289
WRITE (KOUT,1090)	803 6590	4290
LINES= LINES + 2	803 6600	4291
2010 WRITE (KOUT,1100) J,K,(EV(J,K,I),I=1,6),(EN(J,K,I),I=1,6)	803 6610	4292
2020 WRITE (KOUT,1020)	803 6620	4293
C	803 6630	4294
2030 CONTINUE	803 6640	4295
C	803 6650	4296
LINES= LINES+3	803 6660	4297
IF (LINEX-LINES) 2040,2050,2050	803 6670	4298
2040 CALL PAGE	803 6680	4299
LINES= LINES+3	803 6690	4300
2050 WRITE (KOUT,1000)	803 6700	4301
C	803 6710	4302
C	803 6720	4303
C * WRITE ON CALCONPLOT TAPE *	803 6730	4304
C	803 6740	4305
IF (ITFLG(12)-1) 2460,2060,2060	803 6750	4306
2060 IREC1=1	803 6760	4307
IREC2=7	803 6770	4308
XZERO = X(1) - 0.4*BOTU	803 6780	4309
ZZERO = Z(1)	803 6790	4310
C	803 6800	4311
DO 2070 J=1,NSPS	803 6810	4312
YSPN = YSPAN(J)	803 6820	4313
C	803 6830	4314
CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)	803 6840	4315
C	803 6850	4316
YSPN = YSPN/BOTU	803 6860	4317
XLE = (XLE - XZERO)/BOTU	803 6870	4318
XC04 = (XC04 - XZERO)/BOTU	803 6880	4319
XTE = (XTE - XZERO)/BOTU	803 6890	4320
XHE = (XHE - XZERO)/BOTU	803 6900	4321
CW = CW/BOTU	803 6910	4322
CF = CF/BOTU	803 6920	4323
2070 WRITE(KT2)IREC1,IREC2,YSPN,XLE,XC04,XTE,XHE,CW,CF	803 6930	4324
C	803 6940	4325
C	803 6950	4326
IREC1= 2	803 6960	4327
IREC2= 2	803 6970	4328
K=1	803 6980	4329
DO 2100 J=1,NSPS	803 6990	4330
YSPN = EV(J,K,2)	803 7000	4331
C	803 7010	4332
CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)	803 7020	4333
C	803 7030	4334
YSPN = YSPN/BOTU	803 7040	4335
XLE = (XLE - XZERO)/BOTU	803 7050	4336
XTE = (XTE - XZERO)/BOTU	803 7060	4337
IF (ITET) 2080,2080,2090	803 7070	4338
2080 ITET = 1	803 7080	4339
WRITE(KT2)IREC1,IREC2,YSPN,XLE	803 7090	4340
WRITE(KT2)IREC1,IREC2,YSPN,XTE	803 7100	4341
GO TO 2100	803 7110	4342
2090 ITET = -1	803 7120	4343
WRITE(KT2)IREC1,IREC2,YSPN,XTE	803 7130	4344
WRITE(KT2)IREC1,IREC2,YSPN,XLE	803 7140	4345
2100 CONTINUE	803 7150	4346
C	803 7160	4347
C	803 7170	4348
IREC1= 3	803 7180	4349
IREC2= 2	803 7190	4350
ITET = -1	803 7200	4351
DO 2150 K=1,NCV	803 7210	4352
DO 2140 J=1,NSPS	803 7220	4353
IF (ITET) 2110,2110,2120	803 7230	4354
2110 JR= J	803 7240	4355
GO TO 2130	803 7250	4356
2120 JR= NSPS +1-J	803 7260	4357
2130 CONTINUE	803 7270	4358
YSPN = (EV(JR,K,2))/BOTU	803 7280	4359
XLE = (EV(JR,K,1) - 0.25*EC(JR,K) - XZERO)/BOTU	803 7290	4360
2140 WRITE(KT2)IREC1,IREC2,YSPN,XLE	803 7300	4361
ITET = -1*ITET	803 7310	4362
2150 CONTINUE	803 7320	4363
C	803 7330	4364
C	803 7340	4365
IREC1=4	803 7350	4366
IREC2=3	803 7360	4367
C	803 7370	4368
DO 2210 J=1,NSPS	803 7380	4369
C	803 7390	4370
YSPN= EV(J,1,2)	803 7400	4371
YA= ABS(YSPN)	803 7410	4372
M=-1	803 7420	4373
DO 2180 K=1,NY2	803 7430	4374
IF (M) 2160,2180,2180	803 7440	4375
2160 TEST= YA-Y(K)	803 7450	4376
IF (TEST) 2170,2170,2180	803 7460	4377
2170 M= K	803 7470	4378

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2180 CONTINUE
C
  M1=M-1
  IF (M1) 2190,219C,2200
2190 M=2
  M1=1
2200 RAT= ( YA -Y(M1))/(Y(M)-Y(M1))
C
  CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
  DELTAZ= Z(M1) + (Z(M)-Z(M1))*RAT
  TANEPS=E(M1) + (E(M)-E(M1))*RAT/RAD
  TANEPS= TAN(TANEPS)
  ZLE= (-DELTAZ + TANEPS*CW*(XOCREF) )/BOTU
  ZTE= (-DELTAZ + TANEPS*CW*(XOCREF-1.0) )/BOTU
  YSPN= YSPN/BOTU
2210 WRITE(KT2) IREC1,IREC2,YSPN,ZLE,ZTE
C
C
  IREC1= 5
  IREC2= 6
  ZERO = 0.0
  XZERO= X(1) + C(1)*(0.5-XOCREF)
  YZERO= Y(1)
  ZZERO= Z(1)
  PHIR= 45.0/RAD
  PHIP = -PHIR
  PHIQ = 0.5*PHIP
C
C
  DO 2270 J=1,NSPS
C
  YSPN = YSPAN(J)
  YA = ABS(YSPN)
C
  CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
  M=-1
  DO 2240 K=1,NYS
  IF (M) 2220,2240,2240
2220 TEST= YA-Y(K)-0.0001
  IF (TEST) 2230,2230,2240
2230 M=K
2240 CONTINUE
  IF (M-1) 2250,2250,2260
2250 M= 2
2260 M1= M-1
C
  RAT= (YA-Y(M1))/(Y(M)-Y(M1))
  DELTAZ= Z(M1) + (Z(M)-Z(M1))*RAT
  TANEPS= E(M1) + (E(M)-E(M1))*RAT
  TANEPS= TAN(TANEPS/RAD)
C
  ZLE = (-DELTAZ + TANEPS*CW*( XOCREF ) +ZZERO )/BOTU
  YLE = YSPN/BOTU
  XLE = ( XLE -XZERO)/BOTU
  ZTE = (-DELTAZ + TANEPS*CW*(XOCREF-1.0)+ZZERO )/BOTU
  YTE = YLE
  XTE = ( XTE -XZERO)/BOTU
C
  CALL ROTATE( XLE,ZLE, ZERC,ZERO, PHIR, ZERO,ZERO, XLE,ZLE )
  CALL ROTATE( YLE,XLE, ZERC,ZERO, PHIP, ZERO,ZERO, YLE,XLE )
  CALL ROTATE( YLE,ZLE, ZERC,ZERO, PHIQ, ZERO,ZERO, YLE,ZLE )
  CALL ROTATE( XTE,ZTE, ZERO,ZERO, PHIR, ZERO,ZERO, XTE,ZTE )
  CALL ROTATE( YTE,XTE, ZERO,ZERO, PHIP, ZERO,ZERO, YTE,XTE )
  CALL ROTATE( YTE,ZTE, ZERO,ZERO, PHIQ, ZERO,ZERO, YTE,ZTE )
C
2270 WRITE(KT2) IREC1,IREC2,YLE,ZLE,YTE,ZTE,XLE,XTE
C
C
  IREC1= 6
  IREC2= 3
  I=1
C
  DO 2350 J=1,NSPS
C
  YSPN = EV(J,I,2)
  YA = ABS(YSPN)
C
  CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
  M= -1
  DO 2300 K=1,NYS
  IF (M) 2280,2300,2300
2280 TEST= YA-Y(K)-0.0001
  IF (TEST) 2290,2290,2300
2290 M= K
2300 CONTINUE
  IF (M-1) 2310,2310,2320
2310 M= 2
2320 M1= M-1
C
  RAT= (YA-Y(M1))/(Y(M)-Y(M1))
  DELTAZ= Z(M1) + (Z(M)-Z(M1))*RAT
  TANEPS= E(M1) + (E(M)-E(M1))*RAT
  TANEPS= TAN(TANEPS/RAD)
C
  ZLE = (-DELTAZ + TANEPS*CW*( XOCREF ) + ZZERO )/BOTU
  YLE = YSPN/BOTU
  XLE = ( XLE - XZERO )/BOTU
  ZTE = (-DELTAZ + TANEPS*CW*(XOCREF-1.0) + ZZERO )/BOTU
  YTE = YLE
  XTE = ( XTE - XZERO )/BOTU
C
  CALL ROTATE( XLE,ZLE, ZERO,ZERO, PHIR, ZERO,ZERO, XLE,ZLE )
  CALL ROTATE( YLE,XLE, ZERO,ZERO, PHIP, ZERO,ZERO, YLE,XLE )

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803 7480 4379
803 7490 4380
803 7500 4381
803 7510 4382
803 7520 4383
803 7530 4384
803 7540 4385
803 7550 4386
803 7560 4387
803 7570 4388
803 7580 4389
803 7590 4390
803 7600 4391
803 7610 4392
803 7620 4393
803 7630 4394
803 7640 4395
803 7650 4396
803 7660 4397
803 7670 4398
803 7680 4399
803 7690 4400
803 7700 4401
803 7710 4402
803 7720 4403
803 7730 4404
803 7740 4405
803 7750 4406
803 7760 4407
803 7770 4408
803 7780 4409
803 7790 4410
803 7800 4411
803 7810 4412
803 7820 4413
803 7830 4414
803 7840 4415
803 7850 4416
803 7860 4417
803 7870 4418
803 7880 4419
803 7890 4420
803 7900 4421
803 7910 4422
803 7920 4423
803 7930 4424
803 7940 4425
803 7950 4426
803 7960 4427
803 7970 4428
803 7980 4429
803 7990 4430
803 8000 4431
803 8010 4432
803 8020 4433
803 8030 4434
803 8040 4435
803 8050 4436
803 8060 4437
803 8070 4438
803 8080 4439
803 8090 4440
803 8100 4441
803 8110 4442
803 8120 4443
803 8130 4444
803 8140 4445
803 8150 4446
803 8160 4447
803 8170 4448
803 8180 4449
803 8190 4450
803 8200 4451
803 8210 4452
803 8220 4453
803 8230 4454
803 8240 4455
803 8250 4456
803 8260 4457
803 8270 4458
803 8280 4459
803 8290 4460
803 8300 4461
803 8310 4462
803 8320 4463
803 8330 4464
803 8340 4465
803 8350 4466
803 8360 4467
803 8370 4468
803 8380 4469
803 8390 4470
803 8400 4471
803 8410 4472
803 8420 4473
803 8430 4474
803 8440 4475
803 8450 4476
803 8460 4477
803 8470 4478
803 8480 4479
803 8490 4480
803 8500 4481
803 8510 4482
803 8520 4483
803 8530 4484

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CALL ROTATE( YLE,ZLE, ZERC,ZERO, PHIQ, ZERO,ZERO, YLE,ZLF )	803 8540	4485
CALL ROTATE( XTE,ZTE, ZERC,ZERO, PHIR, ZERO,ZERO, XTE,ZTE )	803 8550	4486
CALL ROTATE( YTE,XTE, ZERC,ZERO, PHIP, ZERO,ZERO, YTE,XTE )	803 8560	4487
CALL ROTATE( YTE,ZTE, ZERC,ZERO, PHIQ, ZERO,ZERO, YTE,ZTE )	803 8570	4488
C	803 8580	4489
IF (ITET) 2330,2320,2340	803 8590	4490
2330 ITET = 1	803 8600	4491
WRITE(KT2)IREC1,IREC2,YLE,ZLE,XLE	803 8610	4492
WRITE(KT2)IREC1,IREC2,YTE,ZTE,XTE	803 8620	4493
GO TO 2350	803 8630	4494
2340 ITET = -1	803 8640	4495
WRITE(KT2)IREC1,IREC2,YTE,ZTE,XTE	803 8650	4496
WRITE(KT2)IREC1,IREC2,YLE,ZLE,XLE	803 8660	4497
C	803 8670	4498
2350 CONTINUE	803 8680	4499
C	803 8690	4500
C	803 8700	4501
IREC1= 7	803 8710	4502
IREC2= 3	803 8720	4503
ITET = -1	803 8730	4504
C	803 8740	4505
DO 2450 I=1,NCVPI	803 8750	4506
DO 2440 J=1,NSPS	803 8760	4507
C	803 8770	4508
IF (ITET) 2360,2360,2370	803 8780	4509
2360 JR= J	803 8790	4510
GO TO 2380	803 8800	4511
2370 JR= NSPS +1-J	803 8810	4512
2380 CONTINUE	803 8820	4513
C	803 8830	4514
YSPN= EV(JR,I,2)	803 8840	4515
YA = ABS(YSPN)	803 8850	4516
C	803 8860	4517
CALL CHORDTI(YSPN,XLE,XC04,XTE,XHE,CW,CF)	803 8870	4518
C	803 8880	4519
M= -1	803 8890	4520
DO 2410 K=1,NYS	803 8900	4521
IF (M) 2390,2410,2410	803 8910	4522
2390 TEST= YA -Y(K)-0.0001	803 8920	4523
IF (TEST) 2400,2410,2410	803 8930	4524
2400 M= K	803 8940	4525
2410 CONTINUE	803 8950	4526
IF (M-1) 2420,2420,2430	803 8960	4527
2420 M= 2	803 8970	4528
2430 M1= M-1	803 8980	4529
C	803 8990	4530
RAT= (YA-Y(M1))/(Y(M)-Y(M1))	803 9000	4531
DELTAZ= Z(M1) + ( Z(M)-Z(M1) )*RAT	803 9010	4532
TANEPS= E(M1) + ( E(M)-E(M1) )*RAT	803 9020	4533
TANEPS= TAN(TANEPS/RAD)	803 9030	4534
C	803 9040	4535
XTE = XLF	803 9050	4536
XLE = EV(JR,I,1) -0.25*EC(JR,I)	803 9060	4537
YLE = YSPN/BDTU	803 9070	4538
ZLE = (-DELTAZ + TANEPS*( XTE + CW*XCREF - XLE ) + ZZERO )/BDTU	803 9080	4539
XLE = (XLE-XZERC)/BDTU	803 9090	4540
C	803 9100	4541
CALL ROTATE( XLE,ZLE, ZERC,ZERO, PHIR, ZERO,ZERO, XLE,ZLE )	803 9110	4542
CALL ROTATE( YLE,XLE, ZERO,ZERO, PHIP, ZERO,ZERO, YLE,XLE )	803 9120	4543
CALL ROTATE( YLE,ZLE, ZERC,ZERO, PHIQ, ZERO,ZERO, YLE,ZLE )	803 9130	4544
C	803 9140	4545
2440 WRITE(KT2)IREC1,IREC2,YLE,ZLF,XLE	803 9150	4546
C	803 9160	4547
ITET= -1*ITFT	803 9170	4548
C	803 9180	4549
2450 CONTINUE	803 9190	4550
C	803 9200	4551
C	803 9210	4552
END FILE KT2	803 9220	4553
IFLG(15)= IFLG(15) +1	803 9230	4554
LINES= LINES +2	803 9240	4555
WRITE (KOUT,I(30))IFLG(15)	803 9250	4556
C	803 9260	4557
C	803 9270	4558
2460 CONTINUE	803 9280	4559
C	803 9290	4560
C	803 9300	4561
RETURN	803 9310	4562
C	803 9320	4563
C	803 9330	4564
C	803 9340	4565
END	803 9350	4566
7 FOR 804,804	804 10	4567
C	804 20	4568
C	804 30	4569
C	804 40	4570
SUBROUTINE DLIFT(ALFA,ZHEIGHT)	804 50	4571
C	804 60	4572
* TRW MULTIPLE-SLRFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *804 70		4573
* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *804 80		4574
C	804 90	4575
C	804 100	4576
C	804 110	4577
DOUBLE PRECISION SCALE,SUP,DETERM,AMAT(71,71),VMAT(71)	804 120	4578
DIMENSION P(3),B(3),D(3)	804 130	4579
DIMENSION COS1(3),COS2(3),COS3(3)	804 140	4580
DIMENSION SUMWL(4),SUMSL(4)	804 150	4581
DIMENSION Pw(3),Pw(3),Dw(3)	804 160	4582
C	804 170	4583
COMMON/DATA01/KIN ,KOUT ,KT1 ,KT2 ,LINEX ,LINES	804 180	4584
C	804 190	4585
COMMON/DATA02/IFLG(15) ,FEXECK(15) ,RAD ,PIE	804 200	4586
C	804 210	4587

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COMMON/ DATA05/ W(NGD(15)) ,EY(42,101) ,EC(42,101) ,ES(42,10) 804 220 4588
*,EYE(10) ,ELE(10) ,ETE(10) ,EME(10) ,EG(42,10) 804 230 4589
*,EN(42,10,6) ,EV(42,10,6) ,VVINDX(42,10,3) 804 240 4590
C 804 250 4591
C 804 260 4592
1000 FORMAT(1X) 804 270 4593
1010 FORMAT(1X,/,1X) 804 280 4594
C 804 290 4595
1020 FORMAT(47X,28HVORTEX LATTICE MATRIX DETAIL,/,47X,28(1H*),/,1X) 804 300 4596
1030 FORMAT( 1X,12H J K NP NG, 804 310 4597
2 60H VFS(MAT) VIN(MAT) P(X) P(Y) P(Z) B(X) , 804 320 4598
3 50H B(Y) B(Z) D(X) D(Y) D(Z) ,/,1X) 804 330 4599
1040 FNRMAT(1X,4T3,11E10.4) 804 340 4600
C 804 350 4601
1050 FORMAT(48X,24HLIFT DISTRIBUTION DETAIL,/,48X,24(1H*),/,1X) 804 360 4602
1060 FORMAT(3X,4HJ K,5X,40HP(X) P(Y) P(Z) AREA , 804 370 4603
160HCPN G(X) G(Y) G(Z) VI(X) VI(Y) , 804 380 4604
215HV(IZ) GAMA , /,1X) 804 390 4605
1070 FORMAT( 1X, 2I3, 3F10.3, 2F10.4, 6F10.5, E10.4 ) 804 400 4606
C 804 410 4607
1080 FORMAT(48X,24HSECTION LIFT COEFFICIENTS,/,48X,24(1H*),/,1X) 804 420 4608
1090 FORMAT( 8X,3H J,99H 2Y/B Y C SCL SCL 804 430 4609
1C/B DLIFT SCM(C/4) 1XL 1YL 1ZL ,/,1X) 804 440 4610
1100 FORMAT( 8X,13,F10.4,2F10.3,7F10.4) 804 450 4611
C 804 460 4612
1110 FORMAT(///,47X,25HWING AIRLOAD COEFFICIENTS,/,47X,25(1H*),///,18X, 804 470 4613
2 60H WCL WCDI WCMP WCMR WCMY 1XL , 804 480 4614
3 40H 1YL 1ZL DELTA SCALE ,/, 804 490 4615
4 3X,15HWITH LE SCTION, 5F10.5,3F10.6, 2E10.4,/, 804 500 4616
5 3X,15H NO LE SUCTION , 5F10.5,3F10.6,/,1X ) 804 510 4617
C 804 520 4618
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX 804 530 4619
C 804 540 4620
C 804 550 4621
C 804 560 4622
C 804 570 4623
C * INITIALIZE * 804 580 4624
C 804 590 4625
NSPV = IFLG(3) 804 600 4626
NCV = IFLG(6) 804 610 4627
SPAN = WINGD(1) 804 620 4628
WAREA= WINGD(6) 804 630 4629
WNGC = WINGD(9) 804 640 4630
BOTU= SPAN/2.0 804 650 4631
C 804 660 4632
ALFAR= ALFA/RAD 804 670 4633
TANA = TAN(ALFAR) 804 680 4634
COSA = 1.0/SQRT(1.0+TANA**2) 804 690 4635
SINA = TANA*COSA 804 700 4636
TANV= -TAN(0.5*ALFAR) 804 710 4637
TANVG= -TAN(1.5*ALFAR) 804 720 4638
UNIT = 0.25/PIE 804 730 4639
UNITG= -UNIT 804 740 4640
C 804 750 4641
C 804 760 4642
C * SYMMETRIC OR UNSYMMETRIC TEST * 804 770 4643
C 804 780 4644
NZERO= 1 804 790 4645
IF (IFLG(1)-1) 1120,1130,1130 804 800 4646
1120 CONTINUE 804 810 4647
NSPO2= NSPV/2 804 820 4648
NTEST= NSPV-NSPO2*2 804 830 4649
NZERO= NSPO2 + 1 804 840 4650
1130 CONTINUE 804 850 4651
C 804 860 4652
C 804 870 4653
C 804 880 4654
C * CALCULATE MATRICES VMAT(NV) & AMAT(NG,NV) * 804 890 4655
C 804 900 4656
NV= 0 804 910 4657
NM= 0 804 920 4658
DO 1420 KV=1,NCV 804 930 4659
DO 1390 JV=NZERO,NSPV 804 940 4660
NV= NV+1 804 950 4661
C 804 960 4662
C 804 970 4663
COS1(1)= COSA 804 980 4664
COS1(2)= 0.0 804 990 4665
COS1(3)= -SINA 804 1000 4666
YSPN= EN(JV,KV,2) 804 1010 4667
C 804 1020 4668
CALL CHORDT(YSPN,XLE,XCO4,XTE,XHE,CW,CF) 804 1030 4669
C 804 1040 4670
DO 1140 L=1,3 804 1050 4671
M= L+3 804 1060 4672
COS2(L)= EN(JV,KV,M) 804 1070 4673
1140 P(L)= EN(JV,KV,L) 804 1080 4674
C 804 1090 4675
CALL FLAPSIYSPN,XHE, P,COS2) 804 1100 4676
C 804 1110 4677
CALL DOTP(COS1,COS2,VMATDP) 804 1120 4678
C 804 1130 4679
VMAT(NV)= VMATDP 804 1140 4680
C 804 1150 4681
C 804 1160 4682
DO 1150 L=1,3 804 1170 4683
1150 COS1(L)= COS2(L) 804 1180 4684
C 804 1190 4685
NG= 0 804 1200 4686
DO 1380 KG=1,NCV 804 1210 4687
DO 1370 JG=NZERO,NSPV 804 1220 4688
NG= NG+1 804 1230 4689
C 804 1240 4690
I= JG+1 804 1250 4691
DO 1160 L=1,3 804 1260 4692
B(L)= EV(JG,KG,L) 804 1270 4693

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1160 D(L)= FV( I,KG,L)	804 1280	4694
C	804 1290	4695
YSPN= B(2)	804 1300	4696
CALL CHORDT( YSPN,XLE,XCO4,XTE,XHE,CW,CF )	804 1310	4697
CALL FLAPS( YSPN,XHE,B,COS2 )	804 1320	4698
YSPN= D(2)	804 1330	4699
C	804 1340	4700
CALL CHORDT( YSPN,XLE,XCO4,XTE,XHE,CW,CF )	804 1350	4701
CALL FLAPS( YSPN, XHE,D,COS2 )	804 1360	4702
DO 1170 L=1,3	804 1370	4703
PW(L) = P(L)	804 1380	4704
BW(L) = B(L)	804 1390	4705
1170 DW(L) = D(L)	804 1400	4706
C	804 1410	4707
CALL VORTEX(P,B,D,TANV,UNIT, VI,COS2)	804 1420	4708
CALL DOTP(COS1,COS2,SUM1)	804 1430	4709
C	804 1440	4710
SUM1= SUM1*VI	804 1450	4711
SUM2= 0.0	804 1460	4712
C	804 1470	4713
IF (IFLG(9)-1) 1190,1180,1180	804 1480	4714
1180 CONTINUE	804 1490	4715
CALL REFLEC(B,ZHEIGT,ALFAR,COSA)	804 1500	4716
CALL REFLEC(D,ZHEIGT,ALFAR,COSA)	804 1510	4717
C	804 1520	4718
CALL VORTEX(P,B,D,TANV,UNITG, VI,COS2)	804 1530	4719
CALL DOTP(COS1,COS2,SUM3)	804 1540	4720
C	804 1550	4721
SUM1= SUM1 + SUM3*VI	804 1560	4722
1190 CONTINUE	804 1570	4723
C	804 1580	4724
IF (IFLG(11)-1) 1200,1250,1250	804 1590	4725
1200 JGM= NSPV-JG+1	804 1600	4726
IF (JGM-JG) 1210,1250,1250	804 1610	4727
DO 1420 KV=1,NCV	804 1620	4728
DO 1390 JV=NZERO,NSPV	804 1630	4729
NV= NV+1	804 1640	4730
C	804 1650	4731
C	804 1660	4732
COS1(1)= COSA	804 1670	4733
COS1(2)= 0.0	804 1680	4734
COS1(3)= -SINA	804 1690	4735
YSPN= EN(JV,KV,2)	804 1700	4736
C	804 1710	4737
CALL CHORDT(YSPN,XLE,XCO4,XTE,XHE,CW,CF)	804 1720	4738
C	804 1730	4739
DO 1140 L=1,3	804 1740	4740
M= L+3	804 1750	4741
COS2(L)= EN(JV,KV,M)	804 1760	4742
1140 P(L)= EN(JV,KV,L)	804 1770	4743
C	804 1780	4744
CALL FLAPS(YSPN,XHE, P,COS2)	804 1790	4745
C	804 1800	4746
CALL DOTP(COS1,COS2,VMATDP)	804 1810	4747
C	804 1820	4748
VMAT(NV)= VMATDP	804 1830	4749
C	804 1840	4750
C	804 1850	4751
DO 1150 L=1,3	804 1860	4752
1150 COS1(L)= COS2(L)	804 1870	4753
C	804 1880	4754
NG= 0	804 1890	4755
DO 1380 KG=1,NCV	804 1900	4756
DO 1370 JG=NZERO,NSPV	804 1910	4757
NG= NG+1	804 1920	4758
C	804 1930	4759
I= JG+1	804 1940	4760
DO 1160 L=1,3	804 1950	4761
B(L)= EV(JG,KG,L)	804 1960	4762
1160 D(L)= EV( I,KG,L)	804 1970	4763
C	804 1980	4764
YSPN= B(2)	804 1990	4765
CALL CHORDT( YSPN,XLE,XCO4,XTE,XHE,CW,CF )	804 2000	4766
CALL FLAPS( YSPN,XHE,B,COS2 )	804 2010	4767
YSPN= D(2)	804 2020	4768
CALL CHORDT( YSPN,XLE,XCO4,XTE,XHE,CW,CF )	804 2030	4769
CALL FLAPS( YSPN, XHE,D,COS2 )	804 2040	4770
DO 1170 L=1,3	804 2050	4771
PW(L) = P(L)	804 2060	4772
BW(L) = B(L)	804 2070	4773
1170 DW(L) = D(L)	804 2080	4774
C	804 2090	4775
CALL VORTEX(P,B,D,TANV,UNIT, VI,COS2)	804 2100	4776
CALL DOTP(COS1,COS2,SUM1)	804 2110	4777
C	804 2120	4778
SUM1= SUM1*VI	804 2130	4779
SUM2= 0.0	804 2140	4780
C	804 2150	4781
IF (IFLG(9)-1) 1190,1180,1180	804 2160	4782
1180 CONTINUE	804 2170	4783
CALL REFLEC(B,ZHEIGT,ALFAR,COSA)	804 2180	4784
CALL REFLEC(D,ZHEIGT,ALFAR,COSA)	804 2190	4785
C	804 2200	4786
CALL VORTEX(P,B,D,TANV,UNITG, VI,COS2)	804 2210	4787
CALL DOTP(COS1,COS2,SUM3)	804 2220	4788
C	804 2230	4789
SUM1= SUM1 + SUM3*VI	804 2240	4790
1190 CONTINUE	804 2250	4791
C	804 2260	4792
IF (IFLG(11)-1) 1200,1250,1250	804 2270	4793
1200 JGM= NSPV-JG+1	804 2280	4794
IF (JGM-JG) 1210,1250,1250	804 2290	4795
1210 CONTINUE	804 2300	4796
I= JGM+1	804 2310	4797
DO 1220 L=1,3	804 2320	4798
B(L)= EV(JGM,KG,L)	804 2330	4799

1220 D(LI) = EV( 1,KG,L)	804 2340	4800
C	804 2350	4801
YSPN= B(2)	804 2360	4802
CALL CHORDT( YSPN,XLF,XCD4,XTE,XHE,CW,CF )	804 2370	4803
CALL FLAPS( YSPN,XHE,B,COS2 )	804 2380	4804
YSPN= D(2)	804 2390	4805
CALL CHORDT( YSPN,XLF,XCD4,XTE,XHE,CW,CF )	804 2400	4806
CALL FLAPS( YSPN, XHE,D,COS2 )	804 2410	4807
C	804 2420	4808
CALL VORTEX(P,B,D,TANV,UNIT, VI,COS2)	804 2430	4809
CALL DOTP(COS1,COS2,SUM2)	804 2440	4810
C	804 2450	4811
SUM2= SUM2*VI	804 2460	4812
C	804 2470	4813
IF (IFLG(9)-1) 1240,1230,1230	804 2480	4814
1230 CONTINUE	804 2490	4815
CALL REFLEC(B,ZHEIGT,ALFAR,COSA)	804 2500	4816
CALL REFLEC(D,ZHEIGT,ALFAR,COSA)	804 2510	4817
C	804 2520	4818
CALL VORTEXIP(B,D,TANVG,UNITG, VI,COS2)	804 2530	4819
CALL DOTP(COS1,COS2,SUM4)	804 2540	4820
C	804 2550	4821
SUM2= SUM2 + SUM4*VI	804 2560	4822
1240 CONTINUE	804 2570	4823
C	804 2580	4824
1250 CONTINUE	804 2590	4825
C	804 2600	4826
AMAT(NG,NV)= SUM1+SUM2	804 2610	4827
C	804 2620	4828
C	804 2630	4829
IF (EXECK(15)-1.C) 1260,1360,1360	804 2640	4830
1260 IF (IFLG(10)-5) 1360,1270,1270	804 2650	4831
1270 IF (NM-1) 1280,1280,1340	804 2660	4832
1280 LINES= LINES+4	804 2670	4833
NM= 10	804 2680	4834
IF (LINES-LINES) 1290,1300,1300	804 2690	4835
1290 CALL PAGE	804 2700	4836
LINES= LINES+4	804 2710	4837
1300 WRITE (KOUT,1020)	804 2720	4838
1310 LINES=LINES+2	804 2730	4839
IF (LINES-LINES) 1320,1330,1330	804 2740	4840
1320 CALL PAGE	804 2750	4841
LINES= LINES+2	804 2760	4842
1330 WRITE (KOUT,1030)	804 2770	4843
1340 LINES=LINES+1	804 2780	4844
IF (LINES-LINES) 1320,1350,1350	804 2790	4845
1350 WRITE (KOUT,1040) JV,KV,NV,NG,VMAT(NV),AMAT(NG,NV), (PM(I),I=1,3), (BM(I),I=1,3), (DM(I),I=1,3)	804 2800	4846
1360 CONTINUE	804 2810	4847
C	804 2820	4848
C	804 2830	4849
1370 CONTINUE	804 2840	4850
1380 CONTINUE	804 2850	4851
C	804 2860	4852
1390 CONTINUE	804 2870	4853
C	804 2880	4854
IF (EXECK(15)-1.C) 1400,1420,1420	804 2890	4855
1400 IF (IFLG(10)-5) 1420,1410,1410	804 2900	4856
1410 WRITE (KOUT,1000)	804 2910	4857
LINES=LINES+1	804 2920	4858
C	804 2930	4859
1420 CONTINUE	804 2940	4860
C	804 2950	4861
C	804 2960	4862
LINES= LINES+3	804 2970	4863
IF (LINES-LINES) 1430,1440,1440	804 2980	4864
1430 CALL PAGE	804 2990	4865
GO TO 1450	804 3000	4866
1440 WRITE (KOUT,1010)	804 3010	4867
1450 CONTINUE	804 3020	4868
C	804 3030	4869
C	804 3040	4870
C	804 3050	4871
C	804 3060	4872
C	804 3070	4873
* SOLVE FOR GAMA *	804 3080	4874
C	804 3090	4875
C	804 3100	4876
NM= 0	804 3110	4877
SUP= 0.0	804 3120	4878
DO 1470 J=1,NV	804 3130	4879
DO 1460 K=1,NG	804 3140	4880
NM= NM+1	804 3150	4881
1460 SUP= SUP + DABS( AMAT(K,J) )	804 3160	4882
1470 CONTINUE	804 3170	4883
SCALE = FLOAT(NM)	804 3180	4884
SCALE = SUP/SCALE	804 3190	4885
DO 1490 J=1,NV	804 3200	4886
DO 1480 K=1,NG	804 3210	4887
1480 AMAT(J,K)= AMAT(J,K)/SCALE	804 3220	4888
1490 CONTINUE	804 3230	4889
C	804 3240	4890
CALL DMATIN(AMAT,NV,DETERM)	804 3250	4891
C	804 3260	4892
C	804 3270	4893
NG= 0	804 3280	4894
DO 1530 K=1,NCV	804 3290	4895
DO 1520 J=NZERO,NSPV	804 3300	4896
NG=NG+1	804 3310	4897
C	804 3320	4898
SUP= 0.0	804 3330	4899
NV= 0	804 3340	4900
DO 1510 KV=1,NCV	804 3350	4901
DO 1500 JV=NZERO,NSPV	804 3360	4902
NV=NV+1	804 3370	4903
1500 SUP= SUP - VMAT(NV)*AMAT(NV,NG)	804 3380	4904
1510 CONTINUE	804 3390	4905

C	SUP = SUP/SCALE	804 3400	4906
	SUM = -SUP	804 3410	4907
1520	EG(J,K) = SUM/EXECK(1)	804 3420	4908
1530	CONTINUE	804 3430	4909
C		804 3440	4910
C		804 3450	4911
C		804 3460	4912
C		804 3470	4913
C		804 3480	4914
	IF (IFLG(1)-1) 1540,1570,1570	804 3490	4915
1540	CONTINUE	804 3500	4916
	DO 1560 J=NZERO,NSPV	804 3510	4917
	JM = NSPV+1-J	804 3520	4918
	DO 1550 K=1,NCV	804 3530	4919
1550	EG(JM,K) = FG(J,K)	804 3540	4920
1560	CONTINUE	804 3550	4921
1570	CONTINUE	804 3560	4922
C		804 3570	4923
C		804 3580	4924
C		804 3590	4925
C	* SOLVE FOR INDUCED VELOCITY MATRIX *	804 3600	4926
C		804 3610	4927
	DO 1700 K=1,NCV	804 3620	4928
	DO 1690 J=NZERO,NSPV	804 3630	4929
C		804 3640	4930
	I = J+1	804 3650	4931
	DO 1580 L=1,3	804 3660	4932
	SUMSL(L) = 0.0	804 3670	4933
	B(L) = EV(J,K,L)	804 3680	4934
1580	D(L) = EV(I,K,L)	804 3690	4935
	YSPN = B(2)	804 3700	4936
	CALL CHORDT(YSPN,XLE,XCO4,XTE,XME,CW,CF)	804 3710	4937
	CALL FLAPS(YSPN,XME,B,COS3)	804 3720	4938
	YSPN = D(2)	804 3730	4939
	CALL CHORDT(YSPN,XLE,XCO4,XTE,XME,CW,CF)	804 3740	4940
	CALL FLAPS(YSPN,XME,D,COS3)	804 3750	4941
	DO 1590 L=1,3	804 3760	4942
1590	P(L) = 0.5*(B(L)+D(L))	804 3770	4943
C		804 3780	4944
	DO 1660 KG=1,NCV	804 3790	4945
	DO 1650 JG=1,NSPV	804 3800	4946
C		804 3810	4947
	I = JG+1	804 3820	4948
	DO 1600 L=1,3	804 3830	4949
	B(L) = EV(JG,KG,L)	804 3840	4950
1600	D(L) = EV(I,KG,L)	804 3850	4951
	YSPN = B(2)	804 3860	4952
	CALL CHORDT(YSPN,XLE,XCO4,XTE,XME,CW,CF)	804 3870	4953
	CALL FLAPS(YSPN,XME,B,COS2)	804 3880	4954
	YSPN = D(2)	804 3890	4955
	CALL CHORDT(YSPN,XLE,XCO4,XTE,XME,CW,CF)	804 3900	4956
	CALL FLAPS(YSPN,XME,D,COS2)	804 3910	4957
C		804 3920	4958
	CALL VORTEX(P,B,D,TANV,UNIT,VI,COS2)	804 3930	4959
C		804 3940	4960
	DO 1610 L=1,3	804 3950	4961
1610	SUMSL(L) = SUMSL(L) - EG(JG,KG)*VI*COS2(L)	804 3960	4962
C		804 3970	4963
	IF (IFLG(9)-1) 1640,1620,1620	804 3980	4964
1620	CALL REFLEC(B,ZHEIGT,ALFAR,COSA)	804 3990	4965
	CALL REFLEC(D,ZHEIGT,ALFAR,COSA)	804 4000	4966
C		804 4010	4967
	CALL VORTEX(P,B,D,TANVG,UNITG,VI,COS2)	804 4020	4968
C		804 4030	4969
	DO 1630 L=1,3	804 4040	4970
1630	SUMSL(L) = SUMSL(L) - EG(JG,KG)*VI*COS2(L)	804 4050	4971
1640	CONTINUE	804 4060	4972
1650	CONTINUE	804 4070	4973
1660	CONTINUE	804 4080	4974
C		804 4090	4975
	DO 1670 L=1,3	804 4100	4976
1670	VVINDX(J,K,L) = SUMSL(L)*EXECK(1)	804 4110	4977
	IF (NZERO-2) 1690,1680,1680	804 4120	4978
1680	M = NSPV+1-J	804 4130	4979
	VVINDX(M,K,1) = VVINDX(J,K,1)	804 4140	4980
	VVINDX(M,K,2) = -VVINDX(J,K,2)	804 4150	4981
	VVINDX(M,K,3) = VVINDX(J,K,3)	804 4160	4982
C		804 4170	4983
1690	CONTINUE	804 4180	4984
1700	CONTINUE	804 4190	4985
C		804 4200	4986
C		804 4210	4987
C		804 4220	4988
C	* WING COEFFICIENTS *	804 4230	4989
C		804 4240	4990
	FACT1 = 2.0/WINGD(6)	804 4250	4991
	FACT2 = FACT1/WINGD(9)	804 4260	4992
	FACT3 = FACT1/WINGD(1)	804 4270	4993
	WPMO = 0.0	804 4280	4994
	WRMO = 0.0	804 4290	4995
	WYMO = 0.0	804 4300	4996
	WCLV = 0.0	804 4310	4997
	WCNV = 0.0	804 4320	4998
	WPMV = 0.0	804 4330	4999
	WRMV = 0.0	804 4340	5000
	WYMV = 0.0	804 4350	5001
	NM = 0	804 4360	5002
	DO 1710 L=1,4	804 4370	5003
1710	SUMWL(L) = 0.0	804 4380	5004
C		804 4390	5005
C		804 4400	5006
	DO 1990 J=1,NSPV	804 4410	5007
C		804 4420	5008
	YSPN = EN(J,1,2)	804 4430	5009
	YA = ABS(YSPN)	804 4440	5010
	M = -1	804 4450	5011



DO 1740 L=2,10	804 4460	5012
IF (M) 1720,1740,1740	804 4470	5013
1720 TEST= YA-EYE(L)	804 4480	5014
IF (TEST) 1730,1740,1740	804 4490	5015
1730 M= L	804 4500	5016
1740 CONTINUE	804 4510	5017
IF (M-2) 1750,1760,1760	804 4520	5018
1750 M = 2	804 4530	5019
1760 M1= M-1	804 4540	5020
C	804 4550	5021
RATS= (YA-EYE(M1))/(EYE(M)-EYE(M1))	804 4560	5022
XLE= ELE(M1) + RATS*(ELE(M)-ELE(M1))	804 4570	5023
XHE= EHE(M1) + RATS*(EHE(M)-EHE(M1))	804 4580	5024
TANLE= (ELF(M)-ELE(M1))/(EYE(M)-EYE(M1))	804 4590	5025
COSLE= SQRT(1.0+TANLE**2)	804 4600	5026
C	804 4610	5027
C	804 4620	5028
DO 1960 K=1,NCV	804 4630	5029
NM= NM+1	804 4640	5030
C	804 4650	5031
COS1(1)= VVINDX(J,K,1) + COSA	804 4660	5032
COS1(2)= VVINDX(J,K,2)	804 4670	5033
COS1(3)= VVINDX(J,K,3) - SINA	804 4680	5034
C	804 4690	5035
I = J+1	804 4700	5036
DO 1770 L=1,3	804 4710	5037
B(L)= EV(J,K,L)	804 4720	5038
D(L)= EV(I,K,L)	804 4730	5039
1770 P(L)= 0.5*( B(L)+D(L) )	804 4740	5040
YSPN = B(2)	804 4750	5041
CALL FLAPS(YSPN,XHE,B,COS3)	804 4760	5042
YSPN = D(2)	804 4770	5043
CALL FLAPS(YSPN,XHE,D,COS3)	804 4780	5044
YSPN = P(2)	804 4790	5045
SUM8 = 0.0	804 4800	5046
DO 1780 L=1,3	804 4810	5047
COS2(L)= D(L)-B(L)	804 4820	5048
1780 SUM8 = SUM8 + COS2(L)**2	804 4830	5049
SUM8 = SQRT(SUM8)	804 4840	5050
DO 1790 L=1,3	804 4850	5051
1790 COS2(L) = COS2(L)/SUM8	804 4860	5052
C	804 4870	5053
CALL FLAPS( YSPN,XHE, P,COS3 )	804 4880	5054
C	804 4890	5055
CALL CROSP(COS1,COS2,COS3)	804 4900	5056
C	804 4910	5057
SLIFT= (EY(J,K)/COS2(2))*EG(J,K)	804 4920	5058
C	804 4930	5059
DO 1800 L=1,3	804 4940	5060
1800 SUMSL(L)= SLIFT*COS3(L)	804 4950	5061
C	804 4960	5062
XARM = P(1) - WINGD(11)	804 4970	5063
YARM = P(2)	804 4980	5064
ZARM = P(3) - WINGD(12)	804 4990	5065
WPMO = WPMO + ( XARM*SUMSL(3) + ZARM*SUMSL(1) )*EXECK(13)	804 5000	5066
WRMO = WRMO + ( YARM*SUMSL(3) + ZARM*SUMSL(2) )	804 5010	5067
WYMO = WYMO - ( YARM*SUMSL(1) - XARM*SUMSL(2) )	804 5020	5068
SCTS = -SUMSL(1)	804 5030	5069
IF (SCTS) 1810,1810,1820	804 5040	5070
1810 SCTS = 0.0	804 5050	5071
1820 SNFC = COSLE*SCTS	804 5060	5072
IF (SUMSL(3)) 1830,1840,1840	804 5070	5073
1830 SNFC = -SNFC	804 5080	5074
1840 CONTINUE	804 5090	5075
WCLV= WCLV + SNFC	804 5100	5076
WCDV= WCDV + SCTS	804 5110	5077
XARM = XLE - WINGD(11)	804 5120	5078
WPMV = WPMV + ( XARM*SNFC + ZARM*SCTS )	804 5130	5079
WRMV = WRMV - ( YARM*SNFC )	804 5140	5080
WYMV = WYMV - ( YARM*SCTS )	804 5150	5081
C	804 5160	5082
DO 1850 L=1,3	804 5170	5083
1850 SUMML(L)= SUMML(L) + SUMSL(L)	804 5180	5084
C	804 5190	5085
C	804 5200	5086
IF (EXECK(15)-1.0) 1860,1950,1950	804 5210	5087
1860 IF (IFLG(10)-2) 1550,1870,1870	804 5220	5088
1870 IF (NM-1) 1880,1880,1930	804 5230	5089
1880 LINES= LINES+4	804 5240	5090
IF (LINEX-LINES) 1890,1900,1900	804 5250	5091
1890 CALL PAGE	804 5260	5092
LINES= LINES+4	804 5270	5093
1900 WRITE (KOUT,1050)	804 5280	5094
LINES= LINES+2	804 5290	5095
IF (LINEX-LINES) 1910,1920,1920	804 5300	5096
1910 CALL PAGE	804 5310	5097
LINES= LINES+2	804 5320	5098
1920 WRITE (KOUT,1060)	804 5330	5099
1930 LINES= LINES+1	804 5340	5100
IF (LINEX-LINES) 1910,1940,1940	804 5350	5101
1940 CPLIFT= -2.0*SUMSL(3)/ES(J,K)	804 5360	5102
WRITE (KOUT,1070)J,K,(P(I),I=1,3),ES(J,K),CPLIFT,(COS3(I),I=1,3),(	804 5370	5103
1950 CONTINUE	804 5380	5104
C	804 5390	5105
C	804 5400	5106
1960 CONTINUE	804 5410	5107
C	804 5420	5108
IF (EXECK(15)-1.0) 1970,1990,1990	804 5430	5109
1970 IF (IFLG(10)-2) 1990,1980,1980	804 5440	5110
1980 WRITE (KOUT,1000)	804 5450	5111
LINES=LINES+1	804 5460	5112
1990 CONTINUE	804 5470	5113
C	804 5480	5114
SUMML(4)= 0.0	804 5490	5115
DO 2000 L=1,3	804 5500	5116
	804 5510	5117

2000 SUMML(4)= SUMML(4) + SUMML(1)**2	804 5520	5118
SUMML(4)= SQRT(SUMML(4))	804 5530	5119
DO 2010 L=1,3	804 5540	5120
2010 SUMML(L)= SUMML(L)/SUMML(4)	804 5550	5121
C	804 5560	5122
WCL=-FACT1*SUMML(4)*(SUMML(3)*COSA+SUMML(1)*SINA)	804 5570	5123
WCD= FACT1*SUMML(4)*(SUMML(1)*COSA-SUMML(3)*SINA)	804 5580	5124
WPMO= WPMO*FACT2	804 5590	5125
WRMO= WRMO*FACT3	804 5600	5126
WYMO= WYMO*FACT3	804 5610	5127
SNFC= FACT1*( WCLV*COSA + WCDV*SINA )	804 5620	5128
SCTS= FACT1*( WCDV*COSA - WCLV*SINA )	804 5630	5129
WPMV = WPMO + FACT2*WPMV	804 5640	5130
WRMV= WRMO + FACT3*WRMV	804 5650	5131
WYMV= WYMO + FACT3*WYMV	804 5660	5132
WCLV= WCL - SNFC	804 5670	5133
WCDV= WCD + SCTS	804 5680	5134
C	804 5690	5135
IF (EXECK(15)-1.C) 2020,2050,2050	804 5700	5136
2020 LINES= LINES+3	804 5710	5137
IF (LINEX-LINES) 2030,2040,2040	804 5720	5138
2030 CALL PAGE	804 5730	5139
GO TO 2050	804 5740	5140
2040 WRITE (KOUT,1010)	804 5750	5141
2050 CONTINUE	804 5760	5142
C	804 5770	5143
EXECK(2)= WCL	804 5780	5144
EXECK(3)= WPMO	804 5790	5145
EXECK(4)= WRMO	804 5800	5146
EXECK(5)= WYMO	804 5810	5147
EXECK(6)=(WCLV-WCL)	804 5820	5148
EXECK(7)=(WPMV-WPMO)	804 5830	5149
EXECK(8)=(WCDV-WCD)	804 5840	5150
EXECK(9)= WCD	804 5850	5151
C	804 5860	5152
IF (EXECK(15)-1.C) 2060,2250,2250	804 5870	5153
2060 CONTINUE	804 5880	5154
C	804 5890	5155
C	804 5900	5156
C	804 5910	5157
C * SECTION COEFFICIENTS *	804 5920	5158
C	804 5930	5159
NJ= 0	804 5940	5160
C	804 5950	5161
DO 2220 J=NZERO,ASPV	804 5960	5162
C	804 5970	5163
NJ=NJ+1	804 5980	5164
C	804 5990	5165
SPMD= 0.0	804 6000	5166
YSPN= EN(J,L,2)	804 6010	5167
C	804 6020	5168
CALL CHORD(YSPN,XLE,XCO4,XTE,XHE,CW,CF)	804 6030	5169
C	804 6040	5170
CORD= CW**2	804 6050	5171
C	804 6060	5172
DO 2070 L=1,4	804 6070	5173
2070 SUMSL(L)= 0.0	804 6080	5174
C	804 6090	5175
DO 2120 K=1,NCV	804 6100	5176
C	804 6110	5177
COS1(1)= VVINDX(J,K,1) + COSA	804 6120	5178
COS1(2)= VVINDX(J,K,2)	804 6130	5179
COS1(3)= VVINDX(J,K,3) - SINA	804 6140	5180
C	804 6150	5181
I = J+1	804 6160	5182
DO 2080 L=1,3	804 6170	5183
H(L)= EV(J,K,L)	804 6180	5184
D(L)= EV(I,K,L)	804 6190	5185
2080 P(L)= 0.5*( B(L)+D(L) )	804 6200	5186
YSPN = B(2)	804 6210	5187
CALL FLAPS(YSPN,XHE,B,COS3)	804 6220	5188
YSPN = D(2)	804 6230	5189
CALL FLAPS(YSPN,XHE,D,COS3)	804 6240	5190
YSPN = P(2)	804 6250	5191
SUMR = 0.0	804 6260	5192
DO 2090 L=1,3	804 6270	5193
COS2(L)= D(L)-B(L)	804 6280	5194
2090 SUMR = SUMR + COS2(L)**2	804 6290	5195
SUMR = SQRT(SUMR)	804 6300	5196
DO 2100 L=1,3	804 6310	5197
COS2(L) = COS2(L)/SUMR	804 6320	5198
CALL FLAPS(YSPN,XHE,P,COS3)	804 6330	5199
C	804 6340	5200
CALL CROSP(COS1,COS2,COS3)	804 6350	5201
C	804 6360	5202
SLIFT= EG(J,K)/COS2(2)	804 6370	5203
C	804 6380	5204
DO 2110 L=1,3	804 6390	5205
2110 SUMSL(L)= SUMSL(L) + SLIFT*COS3(L)	804 6400	5206
C	804 6410	5207
XARM= EV(J,K,1) + 0.5*EV(J,K)*EV(J,K,4)/EV(J,K,5) -XCO4	804 6420	5208
SPMD= SPMD + SLIFT*COS3(3)*XARM	804 6430	5209
C	804 6440	5210
2120 CONTINUE	804 6450	5211
C	804 6460	5212
DO 2130 L=1,3	804 6470	5213
2130 SUMSL(4)= SUMSL(4) + SUMSL(L)**2	804 6480	5214
SUMSL(4)= SQRT(SUMSL(4))	804 6490	5215
DO 2140 L=1,3	804 6500	5216
2140 SUMSL(L)= SUMSL(L)/SUMSL(4)	804 6510	5217
C	804 6520	5218
SCL= SUMSL(4)*2.0/CW	804 6530	5219
SPMD= SPMD*2.0/CORD	804 6540	5220
C	804 6550	5221
IF (NJ=1) 2150,2150,2200	804 6560	5222
2150 LINES= LINES+4	804 6570	5223

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      IF (LINEX-LINES) 2160,2170,2170
2160 CALL PAGE
      LINES= LINES+4
2170 WRITE (KOUT,1080)
      LINES=LINES+2
      IF (LINEX-LINES) 2180,2190,2190
2180 CALL PAGE
      LINES= LINES+2
2190 WRITE (KOUT,1090)
2200 LINES= LINES+1
      IF (LINEX-LINES) 2180,2210,2210
2210 YOB= EN(J,1,2)/BOTU
      SPL = 0.5*SCL*CW/BOTU
      SLIFT= SCL*CW*EY(J,1)/WINGD(4)
      WRITE (KOUT,1100)J,YOB,EN(J,1,2),CW,SCL,SPL,SLIFT,SPMO,(SUMSL(I),I=1,3)
      L=1,3)
C
2220 CONTINUE
C
C
      CALL INTERP(ALFA,ZHEIGT,WCL,WCD)
C
C
      RATS= SQRT( WCDV**2 + WCLV**2 )
      COS3(1)= ( WCDV*COSA - WCLV*SINA )/RATS
      COS3(2)= 0.0
      COS3(3)= (-WCLV*COSA - WCDV*SINA )/RATS
C
      LINES=LINES+11
      IF (LINEX-LINES) 2230,2240,2240
2230 CALL PAGE
      LINES= LINES +11
2240 WRITE (KOUT,1110)WCL,WCD,WPMO,WPMO,WYMO,(SUMWL(I),I=1,3),DETERM,SCB04
      LALE,WCLV,WCDV,WPMV,WPMV,WYMV,(COS3(I),I=1,3)
      LINES=LINES+10
C
C
2250 RETURN
C
C
C
      END
      804 6580 5224
      804 6590 5225
      804 6600 5226
      804 6610 5227
      804 6620 5228
      804 6630 5229
      804 6640 5230
      804 6650 5231
      804 6660 5232
      804 6670 5233
      804 6680 5234
      804 6690 5235
      804 6700 5236
      804 6710 5237
      804 6720 5238
      804 6730 5239
      804 6740 5240
      804 6750 5241
      804 6760 5242
      804 6770 5243
      804 6780 5244
      804 6790 5245
      804 6800 5246
      804 6810 5247
      804 6820 5248
      804 6830 5249
      804 6840 5250
      804 6850 5251
      804 6860 5252
      804 6870 5253
      804 6880 5254
      804 6890 5255
      804 6900 5256
      804 6910 5257
      804 6920 5258
      804 6930 5259
      804 6940 5260
      804 6950 5261
      804 6960 5262
      804 6970 5263
      804 6980 5264
      804 6990 5265

V FOR B05,B05
C
C
C
      SUBROUTINE INTERP(ALFA,ZHEIGT,WCLCF,WCDCF)
C
C
C
      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C
      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION XFUN(11), CPFUN(11)
      DIMENSION YSPAN(22), XCORD(22), SPRES(22)
      DIMENSION SLIFT(22),SDRAG(22),CMOMT(22)
      DIMENSION ALIFT(42),ADRAG(42),AMOMT(42)
      DIMENSION FLAPN(22),FLAPX(22),AFLPN(42),AFLPX(42)
      DIMENSION SCLV(22),SPMV(22),SCDV(22),ACLV(42),APMV(42),ACDV(42)
C
      DIMENSION COS1(3),COS2(3),COS3(3)
      DIMENSION SUMSL(4),B(3),D(3),P(3)
C
      COMMON/DATA01/KIN ,KOUT ,KT1 ,KT2 ,LINEX ,LINES
      COMMON/DATA02/IFLG(15) ,EXECK(15) ,RAD ,PIE
      COMMON/DATA05/WINGD(15) ,EY(42,10) ,EC(42,10) ,ES(42,10)
      * ,EYE(10) ,ETE(10) ,EHE(10) ,EG(42,10)
      * ,ENI(42,10,6) ,EVI(42,10,6) ,VVINDX(42,10,3)
      COMMON/DATA06/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELTF1,DELTF2
      * ,NOFLAP,NOAILR
C
      DATA XFUN/ 0.0,0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9,1.0/
C
C
      1000 FORMAT(1X)
      1010 FORMAT(1X,/,1X)
C
      1020 FORMAT(41X,3RHCHORDWISE PRESSURE DISTRIBUTION DETAIL,/,41X,38(1H*)
      1,/,19X,19(2H* ),29HCHORD STATION (X-XLE)/C,19(2H* ),/,19X,
      2 11F9.5,/,19H 2Y/B SCL ,18(2H* ),29HCHORD PRESSURE (CPL
      3-CPU)*1ZL,17(2H* ),/,1X )
      1030 FORMAT(1X,13F9.5 )
C
      1040 FORMAT(41X,41HSPANWISE SECTION LIFT DISTRIBUTION DETAIL,/,41X,41(1805
      1H*),/,33X,15HWITH LE SUCTION,16X,13HNO LE SUCTION,17X,12HFLAP/AIL
      2ERON,/,5X,20H Y 2Y/B ,2(30H SCL SCDF SCM(805
      3C/4)), 30H FCN FCX FCH ,/,1X)
      1050 FORMAT(5X,F10.3,10F10.6 )
C
      1060 FORMAT(1X,/,1X,14H(EDF PLOT FILE,13,1H) )
C
      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
C
      * INITIALIZE *
C
      IF (IFLG(11)-1) 1630,1070,1070
      1070 CONTINUE
C
      ZERO = 0.0
      ZERO1= 0.0
      805 10 5266
      805 20 5267
      805 30 5268
      805 40 5269
      805 50 5270
      805 60 5271
      805 70 5272
      805 80 5273
      805 90 5274
      805 100 5275
      805 110 5276
      805 120 5277
      805 130 5278
      805 140 5279
      805 150 5280
      805 160 5281
      805 170 5282
      805 180 5283
      805 190 5284
      805 200 5285
      805 210 5286
      805 220 5287
      805 230 5288
      805 240 5289
      805 250 5290
      805 260 5291
      805 270 5292
      805 280 5293
      805 290 5294
      805 300 5295
      805 310 5296
      805 320 5297
      805 330 5298
      805 340 5299
      805 350 5300
      805 360 5301
      805 370 5302
      805 380 5303
      805 390 5304
      805 400 5305
      805 410 5306
      805 420 5307
      805 430 5308
      805 440 5309
      805 450 5310
      805 460 5311
      805 470 5312
      805 480 5313
      805 490 5314
      805 500 5315
      805 510 5316
      805 520 5317
      805 530 5318
      805 540 5319
      805 550 5320
      805 560 5321
      805 570 5322
      805 580 5323
      805 590 5324
      805 600 5325
      805 610 5326

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	ZERO2= 0.0	805 620	5327
C	NO= 0	805 630	5328
	N1= 1	805 640	5329
	N2= 2	805 650	5330
	NSPV = IFLG(3)	805 660	5331
	NCV = IFLG(6)	805 670	5332
C		805 680	5333
	IREC4 = 1	805 690	5334
	IWORD1= 2	805 700	5335
	IWORD2= 10	805 710	5336
C		805 720	5337
	SPAN = WINGD(1)	805 730	5338
	WAREA= WINGD(6)	805 740	5339
	WMGC = WINGD(9)	805 750	5340
	BOTU = SPAN/2.0	805 760	5341
C		805 770	5342
	BETAM= EXECK(1)	805 780	5343
	WCL = EXECK(2)	805 790	5344
	WPMO = EXECK(3)	805 800	5345
	WRMO = EXECK(4)	805 810	5346
	WYMO = EXECK(5)	805 820	5347
C		805 830	5348
	FACT1= 2.0/WINGD(6)	805 840	5349
	FACT2= FACT1/WINGD(9)	805 850	5350
	FACT3= FACT1/WINGD(1)	805 860	5351
C		805 870	5352
	ALFAR= ALFA/RAD	805 880	5353
	TANA = TAN(ALFAR)	805 890	5354
	COSA = 1.0/SQRT(1.0+TANA**2)	805 900	5355
	SINA = TANA*COSA	805 910	5356
C		805 920	5357
	NZERO= 1	805 930	5358
	IF (IFLG(1)-1) 1080,1090,1090	805 940	5359
1080	CONTINUE	805 950	5360
	NSPD2= NSPV/2	805 960	5361
	NTEST= NSPV-NSPD2*2	805 970	5362
	NZERO= NSPD2 + 1	805 980	5363
1090	CONTINUE	805 990	5364
C		805 1000	5365
	LINES= LINES +3	805 1010	5366
	IF (LINES-LINES) 1100,1110,1110	805 1020	5367
1100	CALL PAGE	805 1030	5368
	LINES= LINES +3	805 1040	5369
1110	WRITE (KOUT,1010)	805 1050	5370
C		805 1060	5371
C		805 1070	5372
C		805 1080	5373
C		805 1090	5374
C	* SECTION COEFFICIENTS *	805 1100	5375
C		805 1110	5376
	NJ= 0	805 1120	5377
C		805 1130	5378
C		805 1140	5379
	NSPAN = 0	805 1150	5380
C		805 1160	5381
C		805 1170	5382
	DO 1390 J=NZERO,NSPV	805 1180	5383
C		805 1190	5384
	J2= J+1	805 1200	5385
	NJ=NJ+1	805 1210	5386
	NSPAN = NSPAN+1	805 1220	5387
C		805 1230	5388
	YSPN= EN(J,1,2)	805 1240	5389
C		805 1250	5390
	YA= ABS(YSPN)	805 1260	5391
	M= -1	805 1270	5392
	DO 1140 L=2,10	805 1280	5393
	IF (M) 1120,1140,1140	805 1290	5394
1120	TEST= YA-EYE(L)	805 1300	5395
	IF (TEST) 1130,1130,1140	805 1310	5396
1130	M= L	805 1320	5397
1140	CONTINUE	805 1330	5398
	IF (M-2) 1150,1160,1160	805 1340	5399
1150	M= 2	805 1350	5400
1160	M= M-1	805 1360	5401
C		805 1370	5402
	RATS= (YA-EYE(M1))/(EYE(M)-EYE(M1))	805 1380	5403
	XLE = ELE(M1) + RATS*( ELE(M)-ELE(M1) )	805 1390	5404
	XTE = ETE(M1) + RATS*( ETE(M)-ETE(M1) )	805 1400	5405
	XME = EME(M1) + RATS*( EME(M)-EME(M1) )	805 1410	5406
	CW = XTE-XLE	805 1420	5407
	CF = XTE-XME	805 1430	5408
	XCO4= XLF + CW*0.25	805 1440	5409
	TANLF = (ELE(M)-ELE(M1))/(EYE(M)-EYE(M1))	805 1450	5410
	COSLE = SQRT(1.0 + TANLF**2)	805 1460	5411
C		805 1470	5412
	CORD= CW**2	805 1480	5413
C		805 1490	5414
C		805 1500	5415
C	* SECTION LIFT LOOP *	805 1510	5416
C		805 1520	5417
	NX = 0	805 1530	5418
C		805 1540	5419
	SPMO= 0.0	805 1550	5420
C		805 1560	5421
	DO 1170 L=1,4	805 1570	5422
1170	SUMSL(L)= 0.0	805 1580	5423
C		805 1590	5424
	DO 1220 K=1,NCV	805 1600	5425
C		805 1610	5426
	NX= NX+1	805 1620	5427
C		805 1630	5428
	COS1(1)= VVINDX(J,K,1) + COSA	805 1640	5429
	COS1(2)= VVINDX(J,K,2)	805 1650	5430
	COS1(3)= VVINDX(J,K,3) - SINA	805 1660	5431
C		805 1670	5432

I = J+1	805 1680	5433
DO 1180 L=1,3	805 1690	5434
B(L)= EV(J,K,L)	805 1700	5435
D(L)= EV(I,K,L)	805 1710	5436
1180 P(L)= 0.5*( B(L)+D(L) )	805 1720	5437
YSPN = B(2)	805 1730	5438
CALL FLAPS(YSPN,XME,R,COS3)	805 1740	5439
YSPN = D(2)	805 1750	5440
CALL FLAPS(YSPN,XME,D,COS3)	805 1760	5441
YSPN = P(2)	805 1770	5442
SUM8 = 0.0	805 1780	5443
DO 1190 L=1,3	805 1790	5444
COS2(L)= D(L)-B(L)	805 1800	5445
1190 SUM8 = SUM8 + COS2(L)**2	805 1810	5446
SUM8 = SQR(T(SUM8))	805 1820	5447
DO 1200 L=1,3	805 1830	5448
COS2(L) = COS2(L)/SUM8	805 1840	5449
C	805 1850	5450
CALL FLAPS(YSPN,XME,P,COS3)	805 1860	5451
C	805 1870	5452
CALL CROSP(COS1,COS2,COS3)	805 1880	5453
C	805 1890	5454
ZLIFT= EG(J,K)/COS2(2)	805 1900	5455
C	805 1910	5456
SPRES(NX)= 2.0*ZLIFT*COS3(3)/EC(J,K)	805 1920	5457
XCORD(NX)= (P(1)-XLE)/CW	805 1930	5458
C	805 1940	5459
DO 1210 L=1,3	805 1950	5460
1210 SUMSL(L)= SUMSL(L) + ZLIFT*COS3(L)	805 1960	5461
C	805 1970	5462
XARM= P(1)-XCD4	805 1980	5463
SPM0 = SPM0 + ZLIFT*COS3(3)*XARM	805 1990	5464
C	805 2000	5465
1220 CONTINUE	805 2010	5466
C	805 2020	5467
C	805 2030	5468
FLAPN(NSPAN) = -2.0*ZLIFT*COS3(3)/EC(J,NCV)	805 2040	5469
FLAPX(NSPAN) = 2.0*ZLIFT*COS3(1)/EC(J,NCV)	805 2050	5470
C	805 2060	5471
DO 1230 L=1,3	805 2070	5472
1230 SUMSL(4)= SUMSL(4) + SUMSL(L)**2	805 2080	5473
SUMSL(4)= SQR(T(SUMSL(4)))	805 2090	5474
DO 1240 L=1,3	805 2100	5475
1240 SUMSL(L)= SUMSL(L)/SUMSL(4)	805 2110	5476
SUMSL(4)= 2.0*SUMSL(4)/CW	805 2120	5477
C	805 2130	5478
C	805 2140	5479
NX= NX+1	805 2150	5480
SPRES(NX)= 0.0	805 2160	5481
XCORD(NX)= 1.0	805 2170	5482
C	805 2180	5483
CALL CURFIT(XCORD,SPRES,ALIFT, NX,ZERO1,ZERO2,N2,N2)	805 2190	5484
C	805 2200	5485
YSPAN(NSPAN)= YSPN/ROTU	805 2210	5486
SLIFT(NSPAN)=SUMSL(4)*(SUMSL(3)*COSA + SUMSL(1)*SINA)	805 2220	5487
SDRAG(NSPAN)= SUMSL(4)*(SUMSL(1)*COSA - SUMSL(3)*SINA)	805 2230	5488
CMDMT(NSPAN)= 2.0*SPM0/CORD	805 2240	5489
SCTS = -SUMSL(4)*SUMSL(1)	805 2250	5490
IF (SCTS) 1250,1250,1260	805 2260	5491
1250 SCTS = 0.0	805 2270	5492
1260 SNFC = COSLE*SCTS	805 2280	5493
IF (SUMSL(3)) 1270,1280,1280	805 2290	5494
1270 SNFC= -SNFC	805 2300	5495
1280 CONTINUE	805 2310	5496
SLV(NSPAN) = SLIFT(NSPAN) - SNFC*COSA - SCTS*SINA	805 2320	5497
SCDV(NSPAN) = SDRAG(NSPAN) + SCTS*COSA - SNFC*SINA	805 2330	5498
SPMV(NSPAN) = CMDMT(NSPAN) - SNFC*(XCD4-XLE)/CW	805 2340	5499
C	805 2350	5500
C	805 2360	5501
C	805 2370	5502
DXARG= XCORD(NX)/30.0	805 2380	5503
C	805 2390	5504
DO 1300 K=1,31	805 2400	5505
C	805 2410	5506
XARG = DXARG*FLOAT(K-1)	805 2420	5507
YARG = 0.0	805 2430	5508
C	805 2440	5509
IF (K-1) 1300,1300,1290	805 2450	5510
1290 CONTINUE	805 2460	5511
C	805 2470	5512
C	805 2480	5513
CALL CURVE(XCORD,SPRES,ALIFT, XARG,YARG,DUMYK,NX,N1)	805 2490	5514
C	805 2500	5515
1300 CPFUN(K)= -YARG	805 2510	5516
C	805 2520	5517
C	805 2530	5518
IF (J-NZERO) 1310,1310,1340	805 2540	5519
1310 LINES= LINES + 9	805 2550	5520
IF (LINEX-LINES) 1320,1330,1330	805 2560	5521
1320 CALL PAGE	805 2570	5522
LINES= LINES +9	805 2580	5523
1330 WRITE (KOUT,10201)(XFUN(I),I=1,11)	805 2590	5524
1340 IF (LINEX-LINES) 1320,1350,1350	805 2600	5525
1350 LINES= LINES+1	805 2610	5526
WRITE (KJUT,1030)YSPAN(NSPAN),SLIFT(NSPAN),(CPFUN(I),I=1,31,31)	805 2620	5527
C	805 2630	5528
C	805 2640	5529
IF (IFLG(13)-1) 1390,1360,1360	805 2650	5530
1360 CONTINUE	805 2660	5531
C	805 2670	5532
DO 1370 K=1,31	805 2680	5533
XARG = DXARG*FLOAT(K-1)	805 2690	5534
1370 WRITE(KT2) (REC4,I=WORD1,XARG,CPFUN(K))	805 2700	5535
IREC4 = IREC4 + 1	805 2710	5536
IF (J-NSPV) 1390,1380,1380	805 2720	5537
1380 END FILE KT2	805 2730	5538

```

      IREC4= 1
      LINES= LINES +2
      IFLG(15)= IFLG(15) +1
      WRITE (KOUT,1060)IFLG(15)
C
C
1390 CONTINUE
C
      LINES= LINES+3
      IF (LINEX-LINES) 1400,1410,1410
1400 CALL PAGE
      LINES= LINES+3
      GO TO 1420
1410 WRITE (KOUT,1010)
1420 CONTINUE
C
C
      CALL CURFIT(YSPAN, SLIFT,ALIFT, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, SDRAG,ADRAG, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, CMOMT,AMOMT, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, FLAPN,AFLPN, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, FLAPX,AFLPX, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, SCLV, ACLV, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, SCDV, ACDV, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, SPMV, APMV, NSPAN,ZERO1,ZERO2,N2,N2)
C
C
      DELTAB = 1.0/20.0
      WCLCF = 0.0
      WDCDF = 0.0
      SUMSS = 0.0
C
      DO 1580 J=1,41
C
      YOB= DELTAB*FLOAT(J-1) - 1.0
      YORO= YOB
      YSPN= YOBQ*BOTU
C
      IF (NZERO-1) 1440,1440,1430
1430 YOB= ABS(YOB)
1440 CONTINUE
C
      CL = 0.0
      CD = 0.0
      CM = 0.0
      CLV = 0.0
      CDV = 0.0
      CPV = 0.0
      FCN = 0.0
      FCX = 0.0
C
      TEST= ABS(YOB) - 0.999
      IF (TEST) 1450,1460,1460
1450 CONTINUE
C
      CALL CURVE(YSPAN,SLIFT,ALIFT, YOB,CL, DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,SDRAG,ADRAG, YOB,CD, DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,CMOMT,AMOMT, YOB,CM, DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,FLAPN,AFLPN, YOB,FCN,DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,FLAPX,AFLPX, YOB,FCX,DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,SCLV,ACLV, YOB,CLV,DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,SCDV,ACDV, YOB,CDV,DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,SPMV,APMV, YOB,CPV,DUMYK,NSPAN,N1)
C
1460 CONTINUE
C
      CALL CHORDT(YSPN,XLE,XCD4,XTE,XHE,CW,CF)
C
      FCM = -FCN/4.0
C
      CLC1 = CL*CW
      CDC1 = CD*CW
      CWC1 = CW
C
      IF (J-1) 1480,1480,1470
1470 WCLCF = WCLCF + DELTAB*(CLC1+CLC2)
      WDCDF = WDCDF + DELTAB*(CDC1+CDC2)
      SUMSS = SUMSS + DELTAB*(CWC1+CWC2)
1480 CLC2 = CLC1
      CDC2 = CDC1
      CWC2 = CWC1
C
C
      IF (J-1) 1490,1490,1520
1490 LINES= LINES+7
      IF (LINEX-LINES) 1500,1510,1510
1500 CALL PAGE
      LINES= LINES+7
1510 WRITE (KOUT,1040)
1520 IF (LINEX-LINES) 1500,1530,1530
1530 LINES= LINES +1
      NOFLPX= NOFLAP + NMAILR
      IF (NOFLPX) 1540,1540,1550
1540 WRITE (KOUT,1050)YSPN,YORO,CL,CD,CM,CLV,CDV,CPV
      GO TO 1560
1550 WRITE (KOUT,1050)YSPN,YORO,CL,CD,CM,CLV,CDV,CPV,FCN,FCX,FCM
1560 CONTINUE
C
      IF (IFLG(14)-1) 1580,1570,1570
1570 WRITE(KT2)IREC4,IWORD2,YOBQ,CL,CD,CM,FCN,FCX,FCM,CLV,CDV,CPV
C
C

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805 2740 5539
805 2750 5540
805 2760 5541
805 2770 5542
805 2780 5543
805 2790 5544
805 2800 5545
805 2810 5546
805 2820 5547
805 2830 5548
805 2840 5549
805 2850 5550
805 2860 5551
805 2870 5552
805 2880 5553
805 2890 5554
805 2900 5555
805 2910 5556
805 2920 5557
805 2930 5558
805 2940 5559
805 2950 5560
805 2960 5561
805 2970 5562
805 2980 5563
805 2990 5564
805 3000 5565
805 3010 5566
805 3020 5567
805 3030 5568
805 3040 5569
805 3050 5570
805 3060 5571
805 3070 5572
805 3080 5573
805 3090 5574
805 3100 5575
805 3110 5576
805 3120 5577
805 3130 5578
805 3140 5579
805 3150 5580
805 3160 5581
805 3170 5582
805 3180 5583
805 3190 5584
805 3200 5585
805 3210 5586
805 3220 5587
805 3230 5588
805 3240 5589
805 3250 5590
805 3260 5591
805 3270 5592
805 3280 5593
805 3290 5594
805 3300 5595
805 3310 5596
805 3320 5597
805 3330 5598
805 3340 5599
805 3350 5600
805 3360 5601
805 3370 5602
805 3380 5603
805 3390 5604
805 3400 5605
805 3410 5606
805 3420 5607
805 3430 5608
805 3440 5609
805 3450 5610
805 3460 5611
805 3470 5612
805 3480 5613
805 3490 5614
805 3500 5615
805 3510 5616
805 3520 5617
805 3530 5618
805 3540 5619
805 3550 5620
805 3560 5621
805 3570 5622
805 3580 5623
805 3590 5624
805 3600 5625
805 3610 5626
805 3620 5627
805 3630 5628
805 3640 5629
805 3650 5630
805 3660 5631
805 3670 5632
805 3680 5633
805 3690 5634
805 3700 5635
805 3710 5636
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805 3730 5638
805 3740 5639
805 3750 5640
805 3760 5641
805 3770 5642
805 3780 5643
805 3790 5644

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ORIGINAL PAGE IS  
OF POOR QUALITY

C	FOR B06,B06	806	10	5672
C		806	20	5673
C		806	30	5674
C		806	40	5675
C	SUBROUTINE OLITER(IALFA,ZHEIGT,ALFAL,WINGCL,NJOBL)	806	50	5676
C		806	60	5677
C	* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72	*806	70	5678
C	* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971	*806	80	5679
C		806	90	5680
C	XX	806	100	5681
C		806	110	5682
C	DIMENSION YSPAN(121)	806	120	5683
C	DIMENSION ALFA(120), WINGCL(121)	806	130	5684
C	DIMENSION CLAI(12),CLB(12),RCL(12,32),RCM(12,32),RYSPAN(32)	806	140	5685
C	DIMENSION SCLV(12),SPMV(12),SCDV(12),ACLV(12),APMV(12),ACDV(12)	806	150	5686
C	DIMENSION RCLV(2,32),RCLV(2,32),RCOV(2,32),RPMV(2,32)	806	160	5687
C	DIMENSION WCLV(12),WCLV(12),WCPV(12), WCPV(12),WCDIS(12)	806	170	5688
C	DIMENSION SLIFT(12),SDRAG(12),CMQMT(12)	806	180	5689
C	DIMENSION ALIFT(12),ADRAG(12),AMQMT(12)	806	190	5690
C	DIMENSION FLAPN(12),FLAPX(12),AFLPN(12),AFLPX(12)	806	200	5691
C	DIMENSION RCFL(12,32), RCFD(12,32)	806	210	5692
C		806	220	5693
C	DIMENSION COS1(3),COS2(3),COS3(3)	806	230	5694
C	DIMENSION SUMSL(1),B(3),D(3),P(3)	806	240	5695
C	DIMENSION WCD3(3),WCL3(3),WCL4(3)	806	250	5696
C		806	260	5697
C	COMMON/DATA01/KIA ,KOUT ,KT1 ,KT2 ,LINEX ,LINES	806	270	5698
C	COMMON/DATA02/IFLG(15) ,EXECK(15) ,RAD ,PIE	806	280	5699
C	COMMON/DATA05/WINGDI(15) ,EY(12,10) ,EC(12,10) ,ES(12,10)	806	290	5700
C	* ,EY(10) ,ELF(10) ,ETE(10) ,EME(10) ,EG(12,10)	806	300	5701
C	* ,EN(12,10,6) ,EVI(12,10,6) ,VINDX(12,10,3)	806	310	5702
C	COMMON/DATA06/YFF1,YFF2,YFF3,YFF4,YFF5,DELTF1,DELTF2	806	320	5703
C	* ,NDFLAP,NOAILR	806	330	5704
C	COMMON/DATA07/LFLAP,LDRAG	806	340	5705
C		806	350	5706
C		806	360	5707
C		806	370	5708
C	1000 FORMAT(1X)	806	380	5709
C	1010 FORMAT(1X,/,1X)	806	390	5710
C		806	400	5711
C	1020 FORMAT(42X,35HLINEARIZED SOLUTION WITH LE SUCTION/42X35(1H*1//25X,	806	410	5712
C	1 60H ALFA ALFARD WCL WCL CMP CMR ,	806	420	5713
C	2 10H CMY ,/,45X,40H SLOPE SLOPE SLOPE//	806	430	5714
C	3,25X,2F10.3,F10.4,4F10.5,/,/,1X)	806	440	5715
C		806	450	5716
C	1030 FORMAT(30X,50H Y 2Y/B SCLA1 SCLB SCL ,	806	460	5717
C	1 10H SCM(1/4),/,1X )	806	470	5718
C		806	480	5719
C	1040 FORMAT(30X, F10.3, 5F10.5 )	806	490	5720
C		806	500	5721
C	1050 FORMAT(34X,15HWITH LE SUCTION,16X,13HNO LE SUCTION,17X,12HFLAP/ATL	806	510	5722
C	1ERON,/,5X,20H Y 2Y/B ,2(30H SCL SCDI SCM(806	806	520	5723
C	2C/4)), 30H FCN FCX FCH ,/,1X)	806	530	5724
C	1060 FORMAT(5X,F10.3,10F10.6)	806	540	5725
C		806	550	5726
C	1070 FORMAT(1X,/,17X,18HWITH LE SUCTION ,4HWCL=,F10.5,8H / WCDI=,F10.5,	806	560	5727
C	15,12H / WCMC(4)=,F10.5, 7H / L/D=,F10.5,/,18X,13HNO LE SUCTION,4X	806	570	5728
C	2, 4X,F10.5,2H /,EX,F10.5,2H /,10X,F10.5,2H /,5X,F10.5 )	806	580	5729
C		806	590	5730
C	1080 FORMAT(41X,37HLINEARIZED SOLUTION WING COEFFICIENTS,/,41X,37(1H*1,	806	600	5731
C	1 /,44X,15HWITH LE SUCTION,17X,13HNO LE SUCTION,/,	806	610	5732
C	2 30X,5HALFA , 2(30H WCL WCD WCM(4/1),/,1X)	806	620	5733
C	1090 FORMAT( 25X, F10.3, 6F10.4 )	806	630	5734
C		806	640	5735
C	1100 FORMAT(1X,/,1X,14H(EOF PLOT FILE,(3,1H) )	806	650	5736
C		806	660	5737
C	XX	806	670	5738
C		806	680	5739
C		806	690	5740
C		806	700	5741
C		806	710	5742
C</				

NSPV = IFLG(3)	806	770	5748
NCV = IFLG(4)	806	780	5749
NCLFLG= 1	806	790	5750
C	806	800	5751
ZERO = 0.0	806	810	5752
ZERO1= 0.0	806	820	5753
ZERO2= 0.0	806	830	5754
C	806	840	5755
SPAN = WINGD(1)	806	850	5756
WAREA= WINGD(6)	806	860	5757
WMGC = WINGD(9)	806	870	5758
BOTU = SPAN/2.0	806	880	5759
C	806	890	5760
FACT1= 2.0/WINGD(4)	806	900	5761
FACT2= FACT1/WINGD(9)	806	910	5762
FACT3= FACT1/WINGD(1)	806	920	5763
SK INFC= EXECK(10)*2.0	806	930	5764
DELALF= EXECK(12)	806	940	5765
EXECK(15) = 2.0	806	950	5766
C	806	960	5767
NZERO= 1	806	970	5768
IF (IFLG(1)-1) 1110,1120,1120	806	980	5769
1110 CONTINUE	806	990	5770
NSPO2= NSPV/2	806	1000	5771
NTEST= NSPV-NSPO2*2	806	1010	5772
NZERO= NSPO2 + 1	806	1020	5773
1120 CONTINUE	806	1030	5774
C	806	1040	5775
C	806	1050	5776
C	806	1060	5777
C	806	1070	5778
C * LINEARIZED LIFT TWO PASS LOOP *	806	1080	5779
C	806	1090	5780
DO 1420 NCCL=1,2	806	1100	5781
C	806	1110	5782
IF (NCLFLG) 1130,1140,1140	806	1120	5783
1130 ALFA= ALFA + DELALF	806	1130	5784
C	806	1140	5785
CALL DLIFT( ALFA,ZHEIGT)	806	1150	5786
C	806	1160	5787
GO TO 1150	806	1170	5788
1140 NCLFLG= -1	806	1180	5789
C	806	1190	5790
BETAM= EXECK(1)	806	1200	5791
WCL = EXECK(2)	806	1210	5792
WPMO = EXECK(3)	806	1220	5793
WRMO = EXECK(4)	806	1230	5794
WYMO = EXECK(5)	806	1240	5795
C	806	1250	5796
1150 CONTINUE	806	1260	5797
C	806	1270	5798
C	806	1280	5799
ALFAR= ALFA/RAO	806	1290	5800
TANA = TAN(ALFAR)	806	1300	5801
COSA = 1.0/SQRT(1.0+TANA**2)	806	1310	5802
SINA = TANA*COSA	806	1320	5803
WCPDS(NCLC)= EXECK(3)	806	1330	5804
WCLVS(NCLC)= EXECK(6)	806	1340	5805
WCDVS(NCLC)= EXECK(8)	806	1350	5806
WCPVS(NCLC)= EXECK(17)	806	1360	5807
WCDIS(NCLC)= EXECK(19)	806	1370	5808
C	806	1380	5809
C	806	1390	5810
C	806	1400	5811
C	806	1410	5812
C * SECTION COEFFICIENTS *	806	1420	5813
C	806	1430	5814
NJ= 0	806	1440	5815
C	806	1450	5816
C	806	1460	5817
NSPAN = 0	806	1470	5818
C	806	1480	5819
C	806	1490	5820
ON 1330 J=NZERO,NSPV	806	1500	5821
C	806	1510	5822
J2= J+1	806	1520	5823
NJ=NJ+1	806	1530	5824
NSPAN = NSPAN+1	806	1540	5825
C	806	1550	5826
YSPN= FN(J,1,2)	806	1560	5827
C	806	1570	5828
YA= ABS(YSPN)	806	1580	5829
M = -1	806	1590	5830
C	806	1600	5831
DO 1180 L=2,10	806	1610	5832
IF (M) 1160,1180,1180	806	1620	5833
1160 TEST= YA-EYE(L)	806	1630	5834
IF (TEST) 1170,1170,1180	806	1640	5835
1170 M= L	806	1650	5836
1180 CONTINUE	806	1660	5837
IF (M-2) 1190,1200,1200	806	1670	5838
1190 M= 2	806	1680	5839
1200 M1= M-1	806	1690	5840
C	806	1700	5841
RATS= (YA-EYE(M1))/(EYE(M)-EYE(M1))	806	1710	5842
XLE = FLE(M1) + RATS*( ELE(M)-ELE(M1) )	806	1720	5843
XTE = ETE(M1) + RATS*( ETE(M)-ETE(M1) )	806	1730	5844
XHE = EHE(M1) + RATS*( EHE(M)-EHE(M1) )	806	1740	5845
CW = XTE-XLE	806	1750	5846
CF = XTE-XHE	806	1760	5847
XCD4= XLE + CW*CDZ5	806	1770	5848
TANLE = (ELE(M)-ELE(M1))/(EYE(M)-EYE(M1))	806	1780	5849
COSLE = SQRT(1.0+TANLE**2)	806	1790	5850
C	806	1800	5851
CORD= CW**2	806	1810	5852
C	806	1820	5853



C		806 1830	5854
C	* SECTION LIFT LOOP *	806 1840	5855
C		806 1850	5856
C		806 1860	5857
C	SPMD= 0.0	806 1870	5858
C		806 1880	5859
C	DO 1210 L=1,4	806 1890	5860
1210	SUMSL(1)= 0.0	806 1900	5861
C		806 1910	5862
C	DO 1260 K=1,NCV	806 1920	5863
C		806 1930	5864
C		806 1940	5865
C	COS1(1)= VVINDX(J,K,1) + COSA	806 1950	5866
C	COS1(2)= VVINDX(J,K,2)	806 1960	5867
C	COS1(3)= VVINDX(J,K,3) - SINA	806 1970	5868
C		806 1980	5869
C	I = J+1	806 1990	5870
C	DO 1220 L=1,3	806 2000	5871
C	R(L)= EV(J,K,L)	806 2010	5872
C	D(L)= EV(I,K,L)	806 2020	5873
1220	P(L)= 0.5*( R(L)+D(L) )	806 2030	5874
C	YSPN = R(2)	806 2040	5875
C	CALL FLAPS(YSPN,XHE,B,COS3)	806 2050	5876
C	YSPN = D(2)	806 2060	5877
C	CALL FLAPS(YSPN,XHE,D,COS3)	806 2070	5878
C	YSPN = P(2)	806 2080	5879
C	SUMB = 0.0	806 2090	5880
C	DO 1230 L=1,3	806 2100	5881
C	COS2(L)= D(L)-R(L)	806 2110	5882
1230	SUMB = SUMB + COS2(L)**2	806 2120	5883
C	SUMB = SQRT(SUMB)	806 2130	5884
C	DO 1240 L=1,3	806 2140	5885
1240	COS2(L) = COS2(L)/SUMB	806 2150	5886
C		806 2160	5887
C	CALL FLAPS(YSPN,XHE,P,COS3)	806 2170	5888
C		806 2180	5889
C	CALL CROSP(COS1,COS2,COS3)	806 2190	5890
C		806 2200	5891
C	ZLIFT= FG(J,K)	806 2210	5892
C		806 2220	5893
C	DO 1250 L=1,3	806 2230	5894
1250	SUMSL(L)= SUMSL(L) + ZLIFT*COS3(L)	806 2240	5895
C		806 2250	5896
C	XARM= P(1)-XCD4	806 2260	5897
C	SPMD= SPMD + ZLIFT*COS3(1)*XARM	806 2270	5898
C		806 2280	5899
1260	CONTINUE	806 2290	5900
C		806 2300	5901
C		806 2310	5902
C	FLAPN(NSPAN) = -2.0*ZLIFT*COS3(3)/EC(J,NCV)	806 2320	5903
C	FLAPX(NSPAN) = 2.0*ZLIFT*COS3(1)/EC(J,NCV)	806 2330	5904
C		806 2340	5905
C	DO 1270 L=1,3	806 2350	5906
1270	SUMSL(4)= SUMSL(4) + SUMSL(L)**2	806 2360	5907
C	SUMSL(4)= SQRT(SUMSL(4))	806 2370	5908
C	DO 1280 L=1,3	806 2380	5909
1280	SUMSL(L)= SUMSL(L)/SUMSL(4)	806 2390	5910
C	SUMSL(4)= 2.0*SUMSL(4)/CW	806 2400	5911
C		806 2410	5912
C		806 2420	5913
C	YSPAN(NSPAN)= YSPN/BOTU	806 2430	5914
C	SLIFT(NSPAN)=SUMSL(4)*(SUMSL(3)*COSA + SUMSL(1)*SINA)	806 2440	5915
C	SDRAG(NSPAN)= SUMSL(4)*(SUMSL(1)*COSA - SUMSL(3)*SINA)	806 2450	5916
C	CMOMT(NSPAN)= 2.0*SPMD/CORD	806 2460	5917
C	SCTS = -SUMSL(4)*SUMSL(1)	806 2470	5918
C	IF (SCTS) 1290,1290,1300	806 2480	5919
1290	SCTS = 0.0	806 2490	5920
1300	SNFC = COSLE*SCTS	806 2500	5921
C	IF (SUMSL(3)) 1310,1320,1320	806 2510	5922
1310	SNFC= -SNFC	806 2520	5923
1320	CONTINUE	806 2530	5924
C	SCLV(NSPAN)= -SNFC*COSA - SCTS*SINA	806 2540	5925
C	SCDV(NSPAN)= SCTS*COSA - SNFC*SINA	806 2550	5926
C	SPMV(NSPAN)= SNFC*(XLE-XCD4)/CW	806 2560	5927
C		806 2570	5928
C		806 2580	5929
1330	CONTINUE	806 2590	5930
C		806 2600	5931
C		806 2610	5932
C	LINES= LINES+3	806 2620	5933
C	IF (LINEX-LINES) 1340,1350,1350	806 2630	5934
1340	CALL PAGE	806 2640	5935
C	LINES= LINES+3	806 2650	5936
C	GO TO 1360	806 2660	5937
1350	WRITE (KOUT,1010)	806 2670	5938
1360	CONTINUE	806 2680	5939
C		806 2690	5940
C		806 2700	5941
C		806 2710	5942
C	CALL CURFIT(YSPAN, SLIFT,ALIFT, NSPAN,ZERO1,ZERO2,N2,N2)	806 2720	5943
C	CALL CURFIT(YSPAN, SDRAG,ADRAG, NSPAN,ZERO1,ZERO2,N2,N2)	806 2730	5944
C	CALL CURFIT(YSPAN, CMOMT,AMOMT, NSPAN,ZERO1,ZERO2,N2,N2)	806 2740	5945
C	CALL CURFIT(YSPAN, FLAPN,AFLPN, NSPAN,ZERO1,ZERO2,N2,N2)	806 2750	5946
C	CALL CURFIT(YSPAN, FLAPX,AFLPX, NSPAN,ZERO1,ZERO2,N2,N2)	806 2760	5947
C	CALL CURFIT(YSPAN, SCLV, ACLV, NSPAN,ZERO1,ZERO2,N2,N2)	806 2770	5948
C	CALL CURFIT(YSPAN, SCDV, ACDV, NSPAN,ZERO1,ZERO2,N2,N2)	806 2780	5949
C	CALL CURFIT(YSPAN, SPMV, APMV, NSPAN,ZERO1,ZERO2,N2,N2)	806 2790	5950
C		806 2800	5951
C		806 2810	5952
C		806 2820	5953
C	DELTAB= 2.0/30.0	806 2830	5954
C	YSPAND= -1.0	806 2840	5955
C	IF (IFLG(11-1)) 1370,1380,1380	806 2850	5956
1370	DELTAB= 1.0/30.0	806 2860	5957
C	YSPAND= 0.0	806 2870	5958
1380	CONTINUE	806 2880	5959

C	DO 1410 J=1,31	806 2890	5960
C	YDB= DELTAB*FLOAT(J-1) + YSPAN0	806 2900	5961
	YSPN= YDB*BNTU	806 2910	5962
C	CL = 0.0	806 2920	5963
	CD = 0.0	806 2930	5964
	CM = 0.0	806 2940	5965
	CLV = 0.0	806 2950	5966
	CDV = 0.0	806 2960	5967
	CPV = 0.0	806 2970	5968
	FCN = 0.0	806 2980	5969
	FCX = 0.0	806 2990	5970
C	TEST= ABS(YDB) - 0.999	806 3000	5971
	IF (TEST) 1390,1400,1400	806 3010	5972
	1390 CONTINUE	806 3020	5973
C	CALL CURVE(YSPAN,SLIFT,ALIFT, YDB,CL, DUMYK,NSPAN,N1)	806 3030	5974
	CALL CURVE(YSPAN,SDRAG,ADRAG, YDB,CD, DUMYK,NSPAN,N1)	806 3040	5975
	CALL CURVE(YSPAN,CMDMT,AMDMT, YDB,CM, DUMYK,NSPAN,N1)	806 3050	5976
	CALL CURVE(YSPAN,FLAPN,AFLPN, YDB,FCN,DUMYK,NSPAN,N1)	806 3060	5977
	CALL CURVE(YSPAN,FLAPX,AFLPX, YDB,FCX,DUMYK,NSPAN,N1)	806 3070	5978
	CALL CURVE(YSPAN,SCLV, ACLV, YDB,CLV,DUMYK,NSPAN,N1)	806 3080	5979
	CALL CURVE(YSPAN,SCDV, ACDV, YDB,CDV,DUMYK,NSPAN,N1)	806 3090	5980
	CALL CURVE(YSPAN,SPHV, APHV, YDB,CPV,DUMYK,NSPAN,N1)	806 3100	5981
C	1400 CONTINUE	806 3110	5982
C	RCL(NCLC,J) = CL	806 3120	5983
	PCD(NCLC,J) = CD	806 3130	5984
	RCM(NCLC,J) = CM	806 3140	5985
	RCLV(NCLC,J) = CLV	806 3150	5986
	RCDV(NCLC,J) = CDV	806 3160	5987
	RPMV(NCLC,J) = CPV	806 3170	5988
	RCFL(NCLC,J) = FCN*COSA - FCX*SINA	806 3180	5989
	RCFD(NCLC,J) = FCX*COSA + FCX*SINA	806 3190	5990
	RYSPAN( J) = YDB	806 3200	5991
C	1410 CONTINUE	806 3210	5992
C	RCL(NCLC,J) = CL	806 3220	5993
	PCD(NCLC,J) = CD	806 3230	5994
	RCM(NCLC,J) = CM	806 3240	5995
	RCLV(NCLC,J) = CLV	806 3250	5996
	RCDV(NCLC,J) = CDV	806 3260	5997
	RPMV(NCLC,J) = CPV	806 3270	5998
	RCFL(NCLC,J) = FCN*COSA - FCX*SINA	806 3280	5999
	RCFD(NCLC,J) = FCX*COSA + FCX*SINA	806 3290	6000
	RYSPAN( J) = YDB	806 3300	6001
C	1420 CONTINUE	806 3310	6002
C	DELCL= EXECK(2)-WCL	806 3320	6003
	EXECK(15) = 0.0	806 3330	6004
	SCL1= WCL**2	806 3340	6005
	SCL2= SCL1 - EXECK(2)**2	806 3350	6006
	WCLVS(2)= ( WCLVS(1) - WCLVS(2) )/SCL2	806 3360	6007
	WCLVS(1)= WCLVS(1) - WCLVS(2)*SCL1	806 3370	6008
	WCDVS(2)= ( WCDVS(1) - WCDVS(2) )/SCL2	806 3380	6009
	WCDVS(1)= WCDVS(1) - WCDVS(2)*SCL1	806 3390	6010
	WCPVS(2)= ( WCPVS(1) - WCPVS(2) )/SCL2	806 3400	6011
	WCPVS(1)= WCPVS(1) - WCPVS(2)*SCL1	806 3410	6012
	WCPOS(2)= ( WCPOS(1) - WCPOS(2) )/DELCL	806 3420	6013
	WCPOS(1)= WCPOS(1) - WCPOS(2)*WCL	806 3430	6014
	WCDIS(2)= ( WCDIS(1) - WCDIS(2) )/SCL2	806 3440	6015
	WCDIS(1)= 0.0	806 3450	6016
C	DO 1460 J=1,31	806 3460	6017
	CFNS = RCFL(1,J)**2	806 3470	6018
C	TEST = CFNS - RCFL(2,J)**2	806 3480	6019
	ATEST= ABS(ATEST)-0.001	806 3490	6020
	IF (ATEST) 1430,1430,1440	806 3500	6021
	1430 RCFD(2,J)= 0.0	806 3510	6022
	GO TO 1450	806 3520	6023
	1440 RCFD(2,J)= (RCFD(1,J)-RCFD(2,J))/TEST	806 3530	6024
	1450 RCFD(1,J)= RCFD(1,J) - RCFD(2,J)*CFNS	806 3540	6025
	RCFL(2,J)= (RCFL(2,J)-RCFL(1,J))/DELCL	806 3550	6026
	RCFL(1,J)= RCFL(1,J)-RCFL(2,J)*WCL	806 3560	6027
	RCM(2,J)= (RCM(2,J)-RCM(1,J))/DELCL	806 3570	6028
	RCM(1,J)= RCM(1,J) - RCM(2,J)*WCL	806 3580	6029
C	SCL1= WCL**2	806 3590	6030
	SCL2= SCL1-EXECK(2)**2	806 3600	6031
	RCLV(2,J)= (RCLV(1,J)-RCLV(2,J))/SCL2	806 3610	6032
	RCLV(1,J)= RCLV(1,J)-RCLV(2,J)*SCL1	806 3620	6033
	RCDV(2,J)= (RCDV(1,J)-RCDV(2,J))/SCL2	806 3630	6034
	RCDV(1,J)= RCDV(1,J)-RCDV(2,J)*SCL1	806 3640	6035
	RPMV(2,J)= (RPMV(1,J)-RPMV(2,J))/SCL2	806 3650	6036
	RPMV(1,J)= RPMV(1,J)-RPMV(2,J)*SCL1	806 3660	6037
C	SCL1= RCL(1,J)**2	806 3670	6038
	SCL2= SCL1 - RCL(2,J)**2	806 3680	6039
	RCD(2,J)= (RCD(1,J) - RCD(2,J) )/SCL2	806 3690	6040
	RCD(1,J)= RCD(1,J) - RCD(2,J)*SCL1	806 3700	6041
	CLA1(J)= (RCL(2,J)-RCL(1,J))/DELCL	806 3710	6042
	1460 CLA(J)= RCL(1,J) - CLA1(J)*WCL	806 3720	6043
C	WLIFTS= DELCL/DELALF	806 3730	6044
	WPMOSL= (EXECK(3)-WPMO)/DELALF	806 3740	6045
	WRMOSL= (EXECK(4)-WRMO)/DELALF	806 3750	6046
	WYMOSL= (EXECK(5)-WYMO)/DELALF	806 3760	6047
C	ALFA = ALFA - DELALF	806 3770	6048
	ALFARO= ALFA - WCL*WLIFTS	806 3780	6049
C	LINES= LINES+10	806 3790	6050
		806 3800	6051
		806 3810	6052
		806 3820	6053
		806 3830	6054
		806 3840	6055
		806 3850	6056
		806 3860	6057
		806 3870	6058
		806 3880	6059
		806 3890	6060
		806 3900	6061
		806 3910	6062
		806 3920	6063
		806 3930	6064
		806 3940	6065

IF (LINEX-LINES) 1470,1480,1480	806 3950	6066
1470 CALL PAGE	806 3960	6067
LINES= LINES+10	806 3970	6068
1480 WRITE (KOUT,1020)ALFA,ALFARO,WCL,WLIFTS,WPMOSL,WRMOSL,WYMSL	806 3980	6069
C	806 3990	6070
DO 1540 J=1,31	806 4000	6071
IF (J-1) 1490,1490,1520	806 4010	6072
1490 LINES= LINES+ 2	806 4020	6073
IF (LINEX-LINES) 1500,1510,1510	806 4030	6074
1500 CALL PAGE	806 4040	6075
LINES= LINES+2	806 4050	6076
1510 WRITE (KOUT,1030)	806 4060	6077
1520 LINES= LINES+1	806 4070	6078
IF (LINEX-LINES) 1500,1530,1530	806 4080	6079
1530 CONTINUE	806 4090	6080
YSPN= RYSPAN(J)*BOTU	806 4100	6081
WRITE (KOUT,1040)YSPN,RYSPAN(J),CLA1(J),CLB(J),RCL(1,J),RCM(1,J)	806 4110	6082
1540 CONTINUE	806 4120	6083
C	806 4130	6084
C	806 4140	6085
C	806 4150	6086
C * LINEARIZED SOLUTION ARRAY *	806 4160	6087
C	806 4170	6088
IF (WINGCL(1)-1) 1550,1570,1570	806 4180	6089
1550 CONTINUE	806 4190	6090
DO 1560 N=2,NJOBL	806 4200	6091
M= N-1	806 4210	6092
1560 WINGCL(N)= WLIFTS*( ALFAL(M)-ALFARO)	806 4220	6093
1570 CONTINUE	806 4230	6094
SLOPE0 = 0.5/PIE	806 4240	6095
SLOPEW = 1.0/(WLIFTS*RAD)	806 4250	6096
TREC= 0	806 4260	6097
TWORD=10	806 4270	6098
C	806 4280	6099
C	806 4290	6100
DO 1830 N=2,NJOBL	806 4300	6101
C	806 4310	6102
C	806 4320	6103
C	806 4330	6104
WCL= WINGCL(N)	806 4340	6105
ALFA= WCL/WLIFTS + ALFARO	806 4350	6106
SIGNL= 1.0	806 4360	6107
IF (WCL) 1580,1590,1590	806 4370	6108
1580 SIGNL= -1.0	806 4380	6109
1590 CONTINUE	806 4390	6110
TREC= TREC +1	806 4400	6111
C	806 4410	6112
LINES= LINES + LINEX	806 4420	6113
IF (LINEX-LINES) 1600,1610,1610	806 4430	6114
1600 CALL PAGE	806 4440	6115
LINES= LINES +10	806 4450	6116
1610 WRITE (KOUT,1020)ALFA,ALFARO,WCL,WLIFTS,WPMOSL,WRMOSL,WYMSL	806 4460	6117
C	806 4470	6118
DO 1770 J=1,31	806 4480	6119
YSPN= RYSPAN(J)*BOTU	806 4490	6120
RCL(1,J)= CLA1(J)*WCL + CLB(J)	806 4500	6121
C	806 4510	6122
CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)	806 4520	6123
C	806 4530	6124
SCL1= RCL(1,J)**2	806 4540	6125
SCL2= WCL**2	806 4550	6126
RCL(2,J)= RCD(1,J) + RCD(2,J)*SCL1	806 4560	6127
IF (LDRAG-1) 1640,1620,1620	806 4570	6128
1620 RCL(2,J)= 0.0	806 4580	6129
IF (CLA1(J)) 1640,1640,1630	806 4590	6130
1630 RCL(2,J)= (SLOPEW/CLA1(J)-SLOPE0)*SCL1	806 4600	6131
1640 CMAC= RCM(1,J) + RCM(2,J)*WCL	806 4610	6132
C	806 4620	6133
CLV = ( RCLV(1,J) + RCLV(2,J)*SCL2 )*SIGNL + RCL(1,J)	806 4630	6134
CPV = ( RPMV(1,J) + RPMV(2,J)*SCL2 )*SIGNL + CMAC	806 4640	6135
CDV = ( RCDV(1,J) + RCDV(2,J)*SCL2 ) + RCL(2,J)	806 4650	6136
CMLFT= (WINGD(11)-XC04)*(RCL(1,J)*COSA + RCL(2,J)*SINA)	806 4660	6137
FCN = RCL(1,J) + RCL(2,J)*WCL	806 4670	6138
FCX = RCFD(1,J) + RCFD(2,J)*(FCN**2)	806 4680	6139
CFNS= FCN*COSA + FCX*SINA	806 4690	6140
FCX = FCX*COSA - FCN*SINA	806 4700	6141
FCN = CFNS	806 4710	6142
FCM = -FCN/4.0	806 4720	6143
C	806 4730	6144
IF (J-1) 1650,1650,1680	806 4740	6145
1650 LINES= LINES + 4	806 4750	6146
IF (LINEX-LINES) 1660,1660,1670	806 4760	6147
1660 CALL PAGE	806 4770	6148
LINES= LINES + 4	806 4780	6149
1670 WRITE (KOUT,1050)	806 4790	6150
1680 LINES= LINES + 1	806 4800	6151
IF (LINEX-LINES) 1660,1690,1690	806 4810	6152
1690 CONTINUE	806 4820	6153
C	806 4830	6154
NOFLPX= NOFLAP + AOAILR	806 4840	6155
IF (NOFLPX) 1700,1700,1710	806 4850	6156
1700 WRITE (KOUT,1060)YSPN,RYSPAN(J),RCL(1,J),RCL(2,J),CMAC,CLV,CDV,CPV	806 4860	6157
GO TO 1720	806 4870	6158
1710 WRITE (KOUT,1060)YSPN,RYSPAN(J),RCL(1,J),RCL(2,J),CMAC,CLV,CDV,CPV	806 4880	6159
1,FCN,FCX,FCM	806 4890	6160
1720 CONTINUE	806 4900	6161
C	806 4910	6162
IF (J-1) 1730,1730,1740	806 4920	6163
1730 CONTINUE	806 4930	6164
SUMS= 0.0	806 4940	6165
SUMC= 0.0	806 4950	6166
SUML= 0.0	806 4960	6167
SUMD= 0.0	806 4970	6168
SUMP= 0.0	806 4980	6169
GO TO 1750	806 4990	6170
1740 DEL TAS= 0.25*(YSPN-YSPNP)*(CW*CMF)	806 5000	6171

SUMS= SUMS + 2.0*DELTA	806 5010	6172
SUMC= SUMC + DELTA*(CW+CMF)	806 5020	6173
SUML= SUML + DELTA*(RCL(1,J)+RCL1)	806 5030	6174
SUMD= SUMD + DELTA*(RCL(2,J)+RCL2)	806 5040	6175
SUMP= SUMP + DELTA*(CM+RCM(1,J)+CMF*RCM1+CMFT+CMFT1)	806 5050	6176
1750 CONTINUE	806 5060	6177
C	806 5070	6178
CMF= CW	806 5080	6179
YSPN= YSPN	806 5090	6180
RCL1= RCL(1,J)	806 5100	6181
RCL2= RCL(2,J)	806 5110	6182
RCM1= RCM(1,J)	806 5120	6183
CMFT1= CMFT	806 5130	6184
C	806 5140	6185
IF (IFLG(14)-1) 1770,1760,1760	806 5150	6186
1760 WRITE(KT2)IPECN,IWORD,RYSN(J),RCL(1,J),RCL(2,J),CMAC,	806 5160	6187
1 FCN,FCX,FCM, CLV,CDV,CPV	806 5170	6188
1770 CONTINUE	806 5180	6189
C	806 5190	6190
C	806 5200	6191
WCD= SUMD/SUMS	806 5210	6192
WCMAC= WCDPOS(1) + WCDPOS(2)*WCL	806 5220	6193
WLOD= WCL/WCD	806 5230	6194
C	806 5240	6195
SCL2 = WCL**2	806 5250	6196
WCLV = ( WCLVS(1) + WCLVS(2)*SCL2 )*(SIGNL + WCL	806 5260	6197
WPMV = ( WCPVS(1) + WCPVS(2)*SCL2 )*(SIGNL + WCMAC	806 5270	6198
WCDV = ( WCDVS(1) + WCDVS(2)*SCL2 )	806 5280	6199
WLODV= WCLV/WCDV	806 5290	6200
C	806 5300	6201
IF (N-4) 1780,1760,1800	806 5310	6202
1780 M=N-1	806 5320	6203
WCD3(M)= WCD	806 5330	6204
WCL3(M)= WCL	806 5340	6205
WCL4(M)= WCL**2	806 5350	6206
C	806 5360	6207
IF (N-4) 1800,1790,1800	806 5370	6208
1790 WCD3(3) = ( WCD3(2) - WCD3(1) )/( WCL3(2) - WCL3(1) )	806 5380	6209
WCD3(2) = ( WCD3(1) - WCD3(2) )/( WCL3(1) - WCL3(2) )	806 5390	6210
WCL3(3) = ( WCL4(2) - WCL4(1) )/( WCL3(2) - WCL3(1) )	806 5400	6211
WCL3(2) = ( WCL4(1) - WCL4(2) )/( WCL3(1) - WCL3(2) )	806 5410	6212
WCDIS(2)= ( WCD3(2)-WCD3(3) )/( WCL3(2) - WCL3(3) )	806 5420	6213
WCDIS(1)= WCD3(2) - WCDIS(2)*WCL3(2)	806 5430	6214
SKINFC = SKINFC + WCD3(1) - WCDIS(1)*WCL3(1) - WCDIS(2)*WCL4(1)	806 5440	6215
1800 CONTINUE	806 5450	6216
C	806 5460	6217
LINES= LINES+3	806 5470	6218
IF (LINES-LINES) 1810,1820,1820	806 5480	6219
1810 CALL PAGE	806 5490	6220
LINES= LINES+3	806 5500	6221
1820 WRITE (KOUT,1070)WCL,WCD,WCMAC,WLOD,WCLV,WCDV,WPMV,WLODV	806 5510	6222
C	806 5520	6223
1830 CONTINUE	806 5530	6224
C	806 5540	6225
C	806 5550	6226
CALL PAGE	806 5560	6227
WRITE (KOUT,1080)	806 5570	6228
KALFA= (FIX( ALFARO - 2.0 )	806 5580	6229
LINES= LINES + 9	806 5590	6230
IPECN= IPECN +1	806 5600	6231
IWORD= 7	806 5610	6232
C	806 5620	6233
NIMAX= 20.0 -ALFARO	806 5630	6234
DO 1870 N=1,NIMAX	806 5640	6235
ALFA= FLOAT( N + KALFA )	806 5650	6236
WCL = WLFTS*( ALFA-ALFARO )	806 5660	6237
SCL2 = WCL**2	806 5670	6238
WCD = SKINFC + WCDIS(1)*WCL + WCDIS(2)*SCL2	806 5680	6239
WCMAC= WCDPOS(1) + WCDPOS(2)*WCL	806 5690	6240
WCLV = WCLVS(1) + WCLVS(2)*SCL2	806 5700	6241
WCDV = WCDVS(1) + WCDVS(2)*SCL2	806 5710	6242
WPMV = WCPVS(1) + WCPVS(2)*SCL2	806 5720	6243
C	806 5730	6244
IF (WCL) 1840,1850,1850	806 5740	6245
1840 WCLV = WCLVS(1) + WCLVS(1) -WCLV	806 5750	6246
WPMV = WCPVS(1) + WCPVS(1) - WPMV	806 5760	6247
1850 WCLV = WCLV + WCL	806 5770	6248
WCDV = WCDV + WCD	806 5780	6249
WPMV = WPMV + WCMAC	806 5790	6250
C	806 5800	6251
WRITE (KOUT,1090)ALFA,WCL,WCD,WCMAC,WCLV,WCDV,WPMV	806 5810	6252
C	806 5820	6253
IF (IFLG(14)-1) 1870,1860,1860	806 5830	6254
1860 CONTINUE	806 5840	6255
WRITE(KT2)IPECN,IWORD,ALFA,WCL,WCD,WCMAC,WCLV,WCDV,WPMV	806 5850	6256
1870 CONTINUE	806 5860	6257
C	806 5870	6258
C	806 5880	6259
IF (IFLG(14)-1) 1890,1880,1880	806 5890	6260
1880 LINES= LINES +2	806 5900	6261
IFLG(15)= IFLG(15) +1	806 5910	6262
END FILE KT2	806 5920	6263
WRITE (KOUT,1100)IFLG(15)	806 5930	6264
1890 CONTINUE	806 5940	6265
C	806 5950	6266
C	806 5960	6267
1900 RETURN	806 5970	6268
C	806 5980	6269
C	806 5990	6270
C	806 6000	6271
END	806 6010	6272
V FOR 807,807	807 10	6273
C	807 20	6274

C		807	30	6275
C		807	40	6276
C	SUBROUTINE SPANI(IFLAG,NSPS,NDIS,SPAN, YSPAN)	807	50	6277
C		807	60	6278
C	* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *	807	70	6279
C	* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *	807	80	6280
C		807	90	6281
C	XX	807	100	6282
C		807	110	6283
C	DIMENSION YSPAN(42)	807	120	6284
C	COMMON/DATA02/IFLG(15) ,EXECK(15) ,RAD ,PIE	807	130	6285
C	COMMON/DATA04/YFLAP1,YFLAP2,FLAPC	807	140	6286
C	* ,YATLRN,AILRNC,MSMOTH	807	150	6287
C		807	160	6288
C	XX	807	170	6289
C		807	180	6290
C		807	190	6291
C		807	200	6292
C	IF (IFLAG-1) 100C,1020,1250	807	210	6293
C		807	220	6294
C		807	230	6295
C		807	240	6296
C	* FIXED SPACING *	807	250	6297
C		807	260	6298
C	1000 CONTINUE	807	270	6299
C		807	280	6300
C	DELTA= SPAN/FLOAT(NSPS-1)	807	290	6301
C	BOTU= SPAN/2.0 + DELTA	807	300	6302
C		807	310	6303
C	DO 1010 K=1,NSPS	807	320	6304
C	1010 YSPAN(K)=BOTU + DELTA*FLOAT(K)	807	330	6305
C		807	340	6306
C	RETURN	807	350	6307
C	XXXXXX	807	360	6308
C		807	370	6309
C		807	380	6310
C		807	390	6311
C	* VARIABLE SPACING *	807	400	6312
C		807	410	6313
C	1020 CONTINUE	807	420	6314
C		807	430	6315
C	PHI= PIE*( 1.0 + FLOAT(NDIS) )	807	440	6316
C	DPHI= PHI/FLOAT(NSPS-1)	807	450	6317
C	BOTU= SPAN/2.0	807	460	6318
C	DBO = 0.5*SPAN/FLOAT(NDIS+1)	807	470	6319
C		807	480	6320
C		807	490	6321
C	PIEF= PIE	807	500	6322
C	PIEM= 1.0	807	510	6323
C		807	520	6324
C	DO 1040 N=1,NSPS	807	530	6325
C	PHI= DPHI*FLOAT(N-1)	807	540	6326
C	IF (PHI-PIEF) 1040,1040,1030	807	550	6327
C	1030 PIEF= PIE + PIEF	807	560	6328
C	PIEM= PIEM + 2.0	807	570	6329
C	1040 YSPAN(N)= -BOTU + DBO*(PIEM - COS(PHI+PIE-PIEF))	807	580	6330
C		807	590	6331
C		807	600	6332
C	IF (YFLAP2) 1250,1250,1050	807	610	6333
C	1050 YF1= YFLAP1	807	620	6334
C	YF2= YFLAP2	807	630	6335
C	TEST= YFLAP1-1.0	807	640	6336
C	IF (TEST) 1060,1060,1070	807	650	6337
C	1060 YF1= YF1*BOTU	807	660	6338
C	YF2= YF2*BOTU	807	670	6339
C	1070 CONTINUE	807	680	6340
C		807	690	6341
C	IF (NDIS-1) 1250,1250,1080	807	700	6342
C	1080 IF (NDIS-3) 1090,1090,1150	807	710	6343
C	1090 Y1 = DBO*FLOAT(NDIS-1)	807	720	6344
C		807	730	6345
C		807	740	6346
C	* NDIS=2 OR 3 *	807	750	6347
C		807	760	6348
C		807	770	6349
C	RAT1= YF2/Y1	807	780	6350
C	RAT2= (BOTU-YF2)/(BOTU-Y1)	807	790	6351
C	DO 1140 N=1,NSPS	807	800	6352
C	T1 = YSPAN(N) + Y1	807	810	6353
C	T2 = YSPAN(N) - Y1	807	820	6354
C	IF (T1) 1100,1100,1110	807	830	6355
C	1100 YSPAN(N)= -YF2 + (YSPAN(N)+Y1)*RAT2	807	840	6356
C	GO TO 1140	807	850	6357
C	1110 IF (T2) 1120,1120,1130	807	860	6358
C	1120 YSPAN(N)= YSPAN(N)*RAT1	807	870	6359
C	GO TO 1140	807	880	6360
C	1130 YSPAN(N)= YF2 + (YSPAN(N)-Y1)*RAT2	807	890	6361
C	1140 CONTINUE	807	900	6362
C	GO TO 1250	807	910	6363
C		807	920	6364
C	* NDIS= 4 *	807	930	6365
C		807	940	6366
C		807	950	6367
C	1150 Y1= DBO	807	960	6368
C	Y2= 3.0*Y1	807	970	6369
C	RAT0 = YF1/Y1	807	980	6370
C	RAT1 = (YF2-YF1)/(Y2-Y1)	807	990	6371
C	RAT2 = (BOTU-YF2)/(BOTU-Y2)	807	1000	6372
C	DO 1240 N=1,NSPS	807	1010	6373
C	T1 = YSPAN(N) + Y2	807	1020	6374
C	T2 = YSPAN(N) + Y1	807	1030	6375
C	T3 = YSPAN(N) - Y1	807	1040	6376
C	T4 = YSPAN(N) - Y2	807	1050	6377
C	IF (T1) 1160,1160,1170	807	1060	6378
C	1160 YSPAN(N)= -YF2 +(YSPAN(N)+Y2)*RAT2	807	1070	6379
C	GO TO 1240	807	1080	6380
C	1170 IF (T2) 1180,1180,1190			

1180	YSPAN(N)= -YF1 + (YSPAN(N)+Y1)*RAT1	807	1090	6381
	GO TO 1240	807	1100	6382
1190	IF (T3) 1200,1200,1210	807	1110	6383
1200	YSPAN(N)= YSPAN(N)*RAT0	807	1120	6384
	GO TO 1240	807	1130	6385
1210	IF (T4) 1220,1220,1230	807	1140	6386
1220	YSPAN(N)= YF1 + (YSPAN(N)-Y1)*RAT1	807	1150	6387
	GO TO 1240	807	1160	6388
1230	YSPAN(N)= YF2 + (YSPAN(N)-Y2)*RAT2	807	1170	6389
1240	CONTINUE	807	1180	6390
C		807	1190	6391
C		807	1200	6392
1250	RETURN	807	1210	6393
C	XXXXXX	807	1220	6394
C		807	1230	6395
C		807	1240	6396
	END	807	1250	6397
V FOR 808,808		808	10	6398
C		808	20	6399
C		808	30	6400
C		808	40	6401
	SUBROUTINE CHORDI( IFLAG,NCV,NDIS, XV,XN,XC)	808	50	6402
C		808	60	6403
C	* TRW MULTIPLE-SLRFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72	808	70	6404
C	* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971	808	80	6405
C		808	90	6406
C	XX	808	100	6407
C		808	110	6408
	DIMENSION XV(10),XN(10),XC(11)	808	120	6409
	COMMON/DATA02/IFLG(15) ,EXECK(15) ,RAD ,PIE	808	130	6410
C		808	140	6411
C	XX	808	150	6412
C		808	160	6413
C		808	170	6414
C		808	180	6415
	COLDCP= EXECK(11) - 1.0	808	190	6416
	IF (IFLAG-1) 1000,1020,1020	808	200	6417
C		808	210	6418
C		808	220	6419
C		808	230	6420
C	* FIXED SPACING *	808	240	6421
C		808	250	6422
1000	CONTINUE	808	260	6423
	NP1= NCV+1	808	270	6424
	XC(NP1)=1.0	808	280	6425
	DELTA= 1.0/FLOAT(NCV)	808	290	6426
	DELTA1 = -0.75*DELTA	808	300	6427
	DELTA2 = COLDCP*DELTA	808	310	6428
	X = 0.0	808	320	6429
C		808	330	6430
	DO 1010 N=1,NCV	808	340	6431
	X= X + DELTA	808	350	6432
	XC(N)= X	808	360	6433
	XV(N)= X + DELTA1	808	370	6434
1010	XN(N)= X + DELTA2	808	380	6435
C		808	390	6436
	RETURN	808	400	6437
C	XXXXXX	808	410	6438
C		808	420	6439
C		808	430	6440
C		808	440	6441
C	* VARIABLE SPACING *	808	450	6442
C		808	460	6443
1020	CONTINUE	808	470	6444
C		808	480	6445
	NP1= NCV+1	808	490	6446
	PHI= PIE*(1.0 + FLOAT(NDIS))	808	500	6447
	DPH= PHI/FLOAT(NCV)	808	510	6448
	DCO= 0.5/FLOAT(NDIS+1)	808	520	6449
C		808	530	6450
	PIEF= PIE	808	540	6451
	PIEM= 1.0	808	550	6452
	XX= 0.0	808	560	6453
C		808	570	6454
	DO 1050 N=2,NP1	808	580	6455
	M= N-1	808	590	6456
	PHI= DPH*FLOAT(M)	808	600	6457
	IF (PHI-PIEF) 1040,1040,1030	808	610	6458
1030	PIEF= PEF + PIE	808	620	6459
	PIEM= PIEM + 2.0	808	630	6460
1040	PHIX= PHI+PIEF-PIEF	808	640	6461
	XC(M)= DCO*(PIEM-COS(PHIX))	808	650	6462
	DELTA= XC(M)-XX	808	660	6463
	XX = XC(M)	808	670	6464
	XV(M)= XX-0.75*DELTA	808	680	6465
	XN(M)= XX +COLDCP*DELTA	808	690	6466
1050	CONTINUE	808	700	6467
C		808	710	6468
	RETURN	808	720	6469
C	XXXXXX	808	730	6470
C		808	740	6471
C		808	750	6472
C		808	760	6473
	END	808	770	6474
V FOR 809,809		809	10	6475
C		809	20	6476
C		809	30	6477
C		809	40	6478
	SUBROUTINE CHORDT(Y, XLE,XCO4,XTE,XHE,CW,CF)	809	50	6479
C		809	60	6480

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C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *809 70      6481
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *809 80      6482
C      809 90      6483
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX809 100      6484
C      809 110      6485
COMMON/DATA05/WINGD(15) ,EY(42,10) ,EC(42,10) ,ES(42,10) 809 120      6486
*,EYE(10) ,ELE(10) ,ETE(10) ,EME(10) ,EG(42,10) 809 130      6487
*,EN(42,10,6) ,EV(42,10,6) ,VVINDX(42,10,3) 809 140      6488
C      809 150      6489
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX809 160      6490
C      809 170      6491
C      809 180      6492
C      809 190      6493
C      809 200      6494
C      809 210      6495
YA= ABS(Y) 809 220      6496
M = -1 809 230      6497
DO 1020 L=2,10 809 240      6498
IF (M) 1000,1000,1020 809 250      6499
1000 TEST= YA-EYE(L)+0.001 809 260      6500
IF (TEST) 1010,1010,1020 809 270      6501
1010 M= L 809 280      6502
1020 CONTINUE 809 290      6503
IF (M-2) 1030,1040,1040 809 300      6504
1030 M=2 809 310      6505
1040 M1= M-1 809 320      6506
C      809 330      6507
RAT= (YA-EYE(M1))/(EYE(M)-EYE(M1)) 809 340      6508
XLE = ELE(M1) + RAT*( ELE(M)-ELE(M1) ) 809 350      6509
XTE = ETE(M1) + RAT*( ETE(M)-ETE(M1) ) 809 360      6510
XHE = EME(M1) + RAT*( EME(M)-EME(M1) ) 809 370      6511
CW = XTE - XLE 809 380      6512
CF = XTE - XHE 809 390      6513
XC04= XLE + 0.25*CW 809 400      6514
C      809 410      6515
RETURN 809 420      6516
C      809 430      6517
C      809 440      6518
FND

V FNR B10,B10 810 10      6519
C      810 20      6520
C      810 30      6521
C      810 40      6522
SUBROUTINE FLAPS(YF,XHINGE,P,COSF) 810 50      6523
C      810 60      6524
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *810 70      6525
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *810 80      6526
C      810 90      6527
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX810 100      6528
C      810 110      6529
C      810 120      6530
C      810 130      6531
C      810 140      6532
COMMON/DATA00/NSTL ,ALFA0 ,CMAX ,ZHD ,FLAPDX ,AILRDX(2) 810 150      6533
*,TITLE(14) ,STORE(14) 810 160      6534
COMMON/DATA02/IFLG(15) ,EXECK(15) ,RAD ,PIE 810 170      6535
COMMON/DATA04/YFLAP1,YFLAP2,FLAPC 810 180      6536
*,YAILRN,AILRNC,WSMOTH 810 190      6537
COMMON/DATA06/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELTF1,DELTF2 810 200      6538
*,NOFLAP,NOAILR 810 210      6539
COMMON/DATA07/LFLAP,LDRAG,CUTOF1,CUTOF2 810 220      6540
C      810 230      6541
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX810 240      6542
C      810 250      6543
C      810 260      6544
C      810 270      6545
NONO= NOFLAP + NOAILR 810 280      6546
DELTX= P(1)-XHINGE 810 290      6547
IF (DELTX) 1010,1010,1000 810 300      6548
C      810 310      6549
1000 IF (NONO) 1010,1010,1020 810 320      6550
1010 RETURN 810 330      6551
C      810 340      6552
C      810 350      6553
1020 YA= ABS(YF) 810 360      6554
C      810 370      6555
C      810 380      6556
COSX= COSF(1) 810 390      6557
COSZ= COSF(3) 810 400      6558
FLAPD= 0.0 810 410      6559
AILD = 0.0 810 420      6560
C      810 430      6561
TST11= YA - YFF11 810 440      6562
TST12= YA - YFF12 810 450      6563
TST21= YA - YFF21 810 460      6564
TST22= YA - YFF22 810 470      6565
TST31= YA - YFF31 810 480      6566
TST32= YA - YFF32 810 490      6567
C      810 500      6568
C      810 510      6569
IF (NOFLAP) 1110,1110,1030 810 520      6570
1030 IF (YFLAP1) 1070,1070,1040 810 530      6571
1040 IF (TST11) 1110,1110,1050 810 540      6572
1050 IF (TST12) 1060,1070,1070 810 550      6573
1060 FLAPD = 0.5*FLAPDX*(1.0+SIN(PIE*(TST11/DELTF1-0.5))) 810 560      6574
GO TO 1110 810 570      6575
1070 IF (TST21) 1080,1080,1090 810 580      6576
1080 FLAPD = FLAPDX 810 590      6577
GO TO 1110 810 600      6578
1090 IF (TST22) 1100,1110,1110 810 610      6579
1100 FLAPD = 0.5*FLAPDX*(1.0+SIN(PIE*(TST21/DELTF2+0.5))) 810 620      6580
C      810 630      6581
1110 IF (NOAILR) 1210,1120,1120 810 640      6582
1120 AILD = AILRDX(1) 810 650      6583
IF (YF) 1130,1140,1140

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1130 A1LO = A1LROX(2)	B10 660	6584
1140 IF (TST21) 1150,1150,1160	B10 670	6585
1150 A1LO = 0.0	B10 680	6586
GO TO 1210	B10 690	6587
1160 IF (TST22) 1170,1180,1180	B10 700	6588
1170 A1LO = 0.5*A1LO*(1.0 + SIN(PIE*(TST21/DELTF2 -0.5)))	B10 710	6589
GO TO 1210	B10 720	6590
1180 IF (TST31) 1210,1190,1190	B10 730	6591
1190 IF (TST32) 1200,1150,1150	B10 740	6592
1200 A1LO = 0.5*A1LO*(1.0 + SIN(PIE*(TST31/DELTF2+0.5)))	B10 750	6593
1210 TAND = TAN( (A1LO+FLAPD)/RAD)	B10 760	6594
C	B10 770	6595
C	B10 780	6596
COSSD = 1.0/SQRT( 1.0 + TAND**2 )	B10 790	6597
SIND = TAND*COSSD	B10 800	6598
C	B10 810	6599
COSF(1) = COSX*COSSD - COSZ*SIND	B10 820	6600
COSF(3) = COSZ*COSSD + COSX*SIND	B10 830	6601
C	B10 840	6602
IF (FLAP-1) 1220,1230,1230	B10 850	6603
1220 P(1) = P(1) - DELTX*(1.0-COSSD)	B10 860	6604
P(3) = P(3) + DELTX*SIND	B10 870	6605
1230 CONTINUE	B10 880	6606
C	B10 890	6607
RETURN	B10 900	6608
C	B10 910	6609
C	B10 920	6610
C	B10 930	6611
FND	B10 940	6612
V FOR B11,B11	B11 10	6613
C	B11 20	6614
C	B11 30	6615
C	B11 40	6616
SUBROUTINE VORTEX(P,B,D,TANA,GAMA, VI,VCOS)	B11 50	6617
C	B11 60	6618
* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72	B11 70	6619
* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971	B11 80	6620
C	B11 90	6621
XX	B11 100	6622
C	B11 110	6623
DIMENSION P(3),B(3),D(3)	B11 120	6624
DIMENSION COS1(3),COS2(3),COS3(3), X(3),A(3),VCOS(3)	B11 130	6625
DIMENSION G(3)	B11 140	6626
C	B11 150	6627
COMMON/DATA01/KIN ,KOUT ,KT1 ,KT2 ,LINEX ,LINES	B11 160	6628
COMMON/DATA02/IFLG(15) ,EXECK(15) ,RAD ,PIE	B11 170	6629
COMMON/DATA07/LFLAP,LDRAG,CUTOF1,CUTOF2	B11 180	6630
C	B11 190	6631
NAMLIST/DBUGV1/P,B,D,TANA,GAMA,PSIF,VCOS	B11 200	6632
NAMLIST/DBUGV2/PSIF,VCOS	B11 210	6633
NAMLIST/DBUGV3/PSIF,VCOS	B11 220	6634
C	B11 230	6635
1000 FORMAT(1X,/,1X)	B11 240	6636
C	B11 250	6637
C	B11 260	6638
XX	B11 270	6639
C	B11 280	6640
C	B11 290	6641
NOTE= IFLG(10)-8	B11 300	6642
TANAS= TANA**2	B11 310	6643
COSA = 1.0 - TANAS/2.0	B11 320	6644
IF (TANAS-0.0001) 1020,1010,1010	B11 330	6645
1010 COSA = 1.0/SQRT(1-TANAS+1.0)	B11 340	6646
1020 SINA = COSA*TANA	B11 350	6647
C	B11 360	6648
SCALE = SQRT((D(1)-B(1))**2+(D(2)-B(2))**2+(D(3)-B(3))**2)	B11 370	6649
DO 1030 K=1,3	B11 380	6650
X(K) = (P(K)-0.5*(B(K)+D(K)))/SCALE	B11 390	6651
A(K) = (0.5*(D(K)-B(K)))/SCALE	B11 400	6652
1030 VCOS(K) = 0.0	B11 410	6653
C	B11 420	6654
C	B11 430	6655
C	B11 440	6656
* SEGMENT INF-A-B *	B11 450	6657
C	B11 460	6658
H5 = TANA*( X(1)+ A(1))	B11 470	6659
C	B11 480	6660
H51 = (X(1)+A(1))**2 + H5**2	B11 490	6661
H52 = (X(2)+A(2))**2 + (X(3)+A(3)-H5)**2	B11 500	6662
H53 = (X(1)+A(1))**2 + (X(2)+A(2))**2 + (X(3)+A(3))**2	B11 510	6663
H1 = SQRT(H51)	B11 520	6664
H2 = SQRT(H52)	B11 530	6665
C	B11 540	6666
COSG = 0.0	B11 550	6667
SING = 1.0	B11 560	6668
TEST = CUTOF1 - H1	B11 570	6669
C	B11 580	6670
IF (TEST) 1040,1050,1050	B11 590	6671
1040 COSG = (H53-H51-H52)/(2.0*H1*H2)	B11 600	6672
SING = SQRT(ABS(1.-COSG**2))	B11 610	6673
1050 CONTINUE	B11 620	6674
C	B11 630	6675
R = H2*SING	B11 640	6676
H4 = H2*COSG	B11 650	6677
SH14 = H1+H4	B11 660	6678
C	B11 670	6679
PSIF = ( 1.0 +SH14/SQRT(SH14**2+R**2) )/R	B11 680	6680
C	B11 690	6681
COS1(1) = COSA	B11 700	6682
COS1(2) = 0.0	B11 710	6683
COS1(3) = SINA	B11 720	6684
COS2(1) = ( X(1)+A(1)-SH14*COSA )/R	B11 730	6685
COS2(2) = ( X(2)+A(2) )/R	B11 740	6686



C	COS2(3) = (X(3)+A(3)-SH14*SINA)/R	811	750	6687
C	CALL CROSP(COS1,COS2,COS3)	811	760	6688
C	DO 1060 K=1,3	811	770	6689
1060	VCOS(K) = PSIF*CCS3(K)	811	780	6690
C	IF (NOTE) 1080,1070,1070	811	790	6691
1070	WRITE (KOUT,1000)	811	800	6692
	WRITE (KOUT,DBUGV1)	811	810	6693
1080	CONTINUE	811	820	6694
C		811	830	6695
C		811	840	6696
C	* SEGMENT D-E-INF *	811	850	6697
C	H5 = TANA*(X(1)-A(1))	811	860	6698
C	HS1 = (X(1)-A(1))**2 + H5**2	811	870	6699
	HS2 = (X(2)-A(2))**2 + (X(3)-A(3)-H5)**2	811	880	6700
	HS3 = (X(1)-A(1))**2 + (X(2)-A(2))**2 + (X(3)-A(3))**2	811	890	6701
	H1 = SQRT(HS1)	811	900	6702
	H2 = SQRT(HS2)	811	910	6703
C	COSG = 0.0	811	920	6704
	SING = 1.0	811	930	6705
	TEST = CUTOF1 - H1	811	940	6706
C	IF (TEST) 1090,1100,1100	811	950	6707
1090	COSG = (HS3-HS1-HS2)/(2.0*H1*H2)	811	960	6708
	SING = SQRT(ABS(1.0-COSG**2))	811	970	6709
1100	CONTINUE	811	980	6710
C	R = H2*SING	811	990	6711
	H4 = H2*COSG	811	1000	6712
	SH14 = H1+H4	811	1010	6713
C	PSIF = (-1.0 - SH14/SQRT(SH14**2+R**2))/R	811	1020	6714
C	COS1(1) = COSA	811	1030	6715
	COS1(2) = 0.0	811	1040	6716
	COS1(3) = SINA	811	1050	6717
	COS2(1) = (X(1)-A(1)-SH14*COSA)/R	811	1060	6718
	COS2(2) = (X(2)-A(2))/R	811	1070	6719
	COS2(3) = (X(3)-A(3)-SH14*SINA)/R	811	1080	6720
C	CALL CROSP(COS1,COS2,COS3)	811	1090	6721
C	DO 1110 K=1,3	811	1100	6722
1110	VCOS(K) = VCOS(K) + PSIF*CCS3(K)	811	1110	6723
C	IF (NOTE) 1130,1120,1120	811	1120	6724
1120	WRITE (KOUT,DBUGV2)	811	1130	6725
1130	CONTINUE	811	1140	6726
C		811	1150	6727
C		811	1160	6728
C	* SEGMENT B-C-D *	811	1170	6729
C	HS1 = 4.0*(A(1)**2 + A(2)**2 + A(3)**2)	811	1180	6730
	HS2 = (X(1)-A(1))**2 + (X(2)-A(2))**2 + (X(3)-A(3))**2	811	1190	6731
	HS3 = (X(1)+A(1))**2 + (X(2)+A(2))**2 + (X(3)+A(3))**2	811	1200	6732
	H1 = SQRT(HS1)	811	1210	6733
	H2 = SQRT(HS2)	811	1220	6734
C	COSG = (HS3-HS1-HS2)/(2.0*H1*H2)	811	1230	6735
	SING = SQRT(ABS(1.0-COSG**2))	811	1240	6736
	PSIF = 0.0	811	1250	6737
	TEST = ABS(SING) - CUTOF2	811	1260	6738
C	IF (TEST) 1170,1170,1140	811	1270	6739
1140	CONTINUE	811	1280	6740
C	R = H2*SING	811	1290	6741
C	TFST = R/H1 - 10.0*CUTOF1	811	1300	6742
	IF (TEST) 1170,1170,1150	811	1310	6743
1150	CONTINUE	811	1320	6744
C	RS = R**2	811	1330	6745
	H4 = H2*COSG	811	1340	6746
	SH14 = H1+H4	811	1350	6747
	T1 = 1.0 + 2.0*H4/H1	811	1360	6748
C	PSIF = (SH14/SQRT(SH14**2+RS) - H4/SQRT(H4**2+RS))/R	811	1370	6749
C	DO 1160 K=1,3	811	1380	6750
	G(K) = A(K)*T1	811	1390	6751
	COS1(K) = (G(K)-X(K))/R	811	1400	6752
1160	COS2(K) = -2.0*A(K)/H1	811	1410	6753
C	CALL CROSP(COS1,COS2,COS3)	811	1420	6754
C	1170 CONTINUE	811	1430	6755
C	V2 = 0.0	811	1440	6756
C	DO 1180 K=1,3	811	1450	6757
	VCOS(K) = VCOS(K) + PSIF*CCS3(K)	811	1460	6758
1180	V2 = V2 + VCOS(K)**2	811	1470	6759
C	IF (NOTE) 1200,1190,1190	811	1480	6760
1190	WRITE (KOUT,DBUGV3)	811	1490	6761
	LINES = LINEX - 10	811	1500	6762
1200	CONTINUE	811	1510	6763
C		811	1520	6764
		811	1530	6765
		811	1540	6766
		811	1550	6767
		811	1560	6768
		811	1570	6769
		811	1580	6770
		811	1590	6771
		811	1600	6772
		811	1610	6773
		811	1620	6774
		811	1630	6775
		811	1640	6776
		811	1650	6777
		811	1660	6778
		811	1670	6779
		811	1680	6780
		811	1690	6781
		811	1700	6782
		811	1710	6783
		811	1720	6784
		811	1730	6785
		811	1740	6786
		811	1750	6787
		811	1760	6788
		811	1770	6789
		811	1780	6790
		811	1790	6791
		811	1800	6792

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      VI= SQRT(W2)
      DO 1210 K=1,3
1210  VCOS(K)= VCOS(K)/VI
C      VI= VI*(GAMA/SCALE)
C      RETURN
C      XXXXXX
C      END
      B11 1810 6793
      B11 1820 6794
      B11 1830 6795
      B11 1840 6796
      B11 1850 6797
      B11 1860 6798
      B11 1870 6799
      B11 1880 6800
      B11 1890 6801
      B11 1900 6802

      V FOR B12,B12
C
C
C      SUBROUTINE REFLEC(P,ZL,ALFAR,COSR)
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C      DIMENSION P(3)
C      COMMON/DATA01/KIN ,KOUT ,KT1 ,KT2 ,LINEX ,LINES
C      COMMON/DATA02/IFLG(15) ,EXECK(15) ,RAD ,PIE
C      NAMELIST/REFLEX/PX,PY,X1,Y1,PHI,ALFAR,RX,RY,ZL,COSR
C      DATA X2/0.0/, Y2/0.0/
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C      PX= P(3)
C      PY= P(1)
C      X1= ZL/COSR
C      Y1= 0.0
C      PHI= -ALFAR
C      NOTE= IFLG(10)-15
C
C      CALL ROTATE(PX,PY,X1,Y1,PHI,X2,Y2,RX,RY)
C
C      IF (NOTE) 1010,1010,1000
1000 WRITE (KOUT,REFLEX)
1010 CONTINUE
C
C      RX=-RX
C
C      CALL ROTATE(RX,RY,X2,Y2,ALFAR,X1,Y1,PX,PY)
C
C      IF (NOTE) 1030,1030,1020
1020 WRITE (KOUT,REFLEX)
      LINES= LINES+24
1030 CONTINUE
C
C      P(3)= PX
C      P(1)= PY
C
C      RETURN
C      XXXXXX
C      END
      B12 10 6803
      B12 20 6804
      B12 30 6805
      B12 40 6806
      B12 50 6807
      B12 60 6808
      B12 70 6809
      B12 80 6810
      B12 90 6811
      B12 100 6812
      B12 110 6813
      B12 120 6814
      B12 130 6815
      B12 140 6816
      B12 150 6817
      B12 160 6818
      B12 170 6819
      B12 180 6820
      B12 190 6821
      B12 200 6822
      B12 210 6823
      B12 220 6824
      B12 230 6825
      B12 240 6826
      B12 250 6827
      B12 260 6828
      B12 270 6829
      B12 280 6830
      B12 290 6831
      B12 300 6832
      B12 310 6833
      B12 320 6834
      B12 330 6835
      B12 340 6836
      B12 350 6837
      B12 360 6838
      B12 370 6839
      B12 380 6840
      B12 390 6841
      B12 400 6842
      B12 410 6843
      B12 420 6844
      B12 430 6845
      B12 440 6846
      B12 450 6847
      B12 460 6848
      B12 470 6849
      B12 480 6850
      B12 490 6851
      B12 500 6852

      V FOR B13,B13
C
C
C      SUBROUTINE DMATIA(N,DETERM)
C
C      MATRIX INVERSION WITH ACCOMPANYING SOLUTION OF LINEAR EQUATIONS
C      * VERSION 2 ROUTINE (DOUBLE PRECISION-LANGLEY MATINV SUBROUTINE) *
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C      DOUBLE PRECISION R1,R2,DETERM,AMAX,T,SWAP,PIVOT,PIVOT1
C      DOUBLE PRECISION IPIVOT(71),A(71,71),B(1,1),INDEX(71,2)
C      EQUIVALENCE (IRCH,JROW), (ICOLU,JCOLU), (AMAX, T, SWAP)
C      M= 0
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C      INITIALIZATION
C
1000 ISCALE=0
1010 R1 = 1.E36
1020 R2=1.0/R1
1030 DETERM=L.O
1040 DO 1050 J=1,N
1050 IPIVOT(J)=0
1060 DO 1630 I=1,N
C
C      SEARCH FOR PIVOT ELEMENT
C
1070 AMAX=0.0
1080 DO 1170 J=1,N
1090 IF (IPIVOT(J)-1) 1100,1170,1100
1100 DO 1160 K=1,N
1110 IF (IPIVOT(K)-1) 1120,1160,1150
      B13 10 6853
      B13 20 6854
      B13 30 6855
      B13 40 6856
      B13 50 6857
      B13 60 6858
      B13 70 6859
      B13 80 6860
      B13 90 6861
      B13 100 6862
      B13 110 6863
      B13 120 6864
      B13 130 6865
      B13 140 6866
      B13 150 6867
      B13 160 6868
      B13 170 6869
      B13 180 6870
      B13 190 6871
      B13 200 6872
      B13 210 6873
      B13 220 6874
      B13 230 6875
      B13 240 6876
      B13 250 6877
      B13 260 6878
      B13 270 6879
      B13 280 6880
      B13 290 6881
      B13 300 6882
      B13 310 6883
      B13 320 6884
      B13 330 6885
      B13 340 6886
      B13 350 6887
      B13 360 6888
      B13 370 6889
      B13 380 6890
      B13 390 6891
      B13 400 6892

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1120 IF (DABS(AMAX)-DABS(A(J,K))) 1130,1160,1160	813 410	6893
1130 IROW=J	813 420	6894
1140 ICOLUM=K	813 430	6895
1150 AMAX=A(J,K)	813 440	6896
1160 CONTINUE	813 450	6897
1170 CONTINUE	813 460	6898
IF (AMAX) 1190,1180,1190	813 470	6899
1180 DETERM=0.0	813 480	6900
ISCALE=0	813 490	6901
GO TO 1750	813 500	6902
C XXXXXX	813 510	6903
C	813 520	6904
C	813 530	6905
1190 IPIVOT(ICOLUM)=IPIVOT(ICOLUM)+1	813 540	6906
C	813 550	6907
C INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL	813 560	6908
C	813 570	6909
1200 IF (IROW-ICOLUM) 1210,1310,1210	813 580	6910
1210 DETERM=-DETERM	813 590	6911
1220 DO 1250 L=1,N	813 600	6912
1230 SWAP=A(IROW,L)	813 610	6913
1240 A(IROW,L)=A(ICOLUM,L)	813 620	6914
1250 A(ICOLUM,L)=SWAP	813 630	6915
C	813 640	6916
C	813 650	6917
1260 IF (M) 1310,1310,1270	813 660	6918
1270 DO 1300 L=1,M	813 670	6919
1280 SWAP=B(IROW,L)	813 680	6920
1290 B(IROW,L)=B(ICOLUM,L)	813 690	6921
1300 B(ICOLUM,L)=SWAP	813 700	6922
1310 INDEX(I,1)=IROW	813 710	6923
1320 INDEX(I,2)=ICOLUM	813 720	6924
1330 PIVOT=A(ICOLUM,ICOLUM)	813 730	6925
IF (PIVOT) 1340,1180,1340	813 740	6926
C	813 750	6927
C SCALE THE DETERMINANT	813 760	6928
C	813 770	6929
1340 PIVOTI=PIVOT	813 780	6930
1350 IF (DABS(DETERM)-R1) 1380,1360,1360	813 790	6931
1360 DETERM=DETERM/R1	813 800	6932
ISCALE=ISCALE+1	813 810	6933
IF (DABS(DETERM)-R1) 1410,1370,1370	813 820	6934
1370 DETERM=DETERM/R1	813 830	6935
ISCALE=ISCALE+1	813 840	6936
GO TO 1410	813 850	6937
1380 IF (DABS(DETERM)-R2) 1390,1390,1410	813 860	6938
1390 DETERM=DETERM*R1	813 870	6939
ISCALE=ISCALE-1	813 880	6940
IF (DABS(DETERM)-R2) 1400,1400,1410	813 890	6941
1400 DETERM=DETERM*R1	813 900	6942
ISCALE=ISCALE-1	813 910	6943
1410 IF (DABS(PIVOTI)-R1) 1440,1420,1420	813 920	6944
1420 PIVOTI=PIVOTI/R1	813 930	6945
ISCALE=ISCALE+1	813 940	6946
IF (DABS(PIVOTI)-R1) 1470,1430,1430	813 950	6947
1430 PIVOTI=PIVOTI/R1	813 960	6948
ISCALE=ISCALE+1	813 970	6949
GO TO 1470	813 980	6950
1440 IF (DABS(PIVOTI)-R2) 1450,1450,1470	813 990	6951
1450 PIVOTI=PIVOTI*R1	813 1000	6952
ISCALE=ISCALE-1	813 1010	6953
IF (DABS(PIVOTI)-R2) 1460,1460,1470	813 1020	6954
1460 PIVOTI=PIVOTI*R1	813 1030	6955
ISCALE=ISCALE-1	813 1040	6956
1470 DETERM=DETERM*PIVOTI	813 1050	6957
C	813 1060	6958
C DIVIDE PIVOT ROW BY PIVOT ELEMENT	813 1070	6959
C	813 1080	6960
1480 A(ICOLUM,ICOLUM)=1.0	813 1090	6961
1490 DO 1500 L=1,N	813 1100	6962
1500 A(ICOLUM,L)=A(ICOLUM,L)/PIVOT	813 1110	6963
C	813 1120	6964
C	813 1130	6965
1510 IF (M) 1540,1540,1520	813 1140	6966
1520 DO 1530 L=1,M	813 1150	6967
1530 B(ICOLUM,L)=B(ICOLUM,L)/PIVOT	813 1160	6968
C	813 1170	6969
C REDUCE NON-PIVOT ROWS	813 1180	6970
C	813 1190	6971
1540 DO 1630 L1=1,N	813 1200	6972
1550 IF (L1-ICOLUM) 1560,1630,1560	813 1210	6973
1560 T=A(L1,ICOLUM)	813 1220	6974
1570 A(L1,ICOLUM)=0.0	813 1230	6975
1580 DO 1590 L=1,N	813 1240	6976
1590 A(L1,L)=A(L1,L)-A(ICOLUM,L)*T	813 1250	6977
C	813 1260	6978
C	813 1270	6979
1600 IF (M) 1630,1630,1610	813 1280	6980
1610 DO 1620 L=1,M	813 1290	6981
1620 B(L1,L)=B(L1,L)-B(ICOLUM,L)*T	813 1300	6982
1630 CONTINUE	813 1310	6983
C	813 1320	6984
C INTERCHANGE COLUMNS	813 1330	6985
C	813 1340	6986
1640 DO 1740 I=1,N	813 1350	6987
1650 L=N+1-I	813 1360	6988
1660 IF (INDEX(L,1)-INDEX(L,2)) 1670,1740,1670	813 1370	6989
1670 JROW=INDEX(L,1)	813 1380	6990
1680 JCOLUM=INDEX(L,2)	813 1390	6991
1690 DO 1730 K=1,N	813 1400	6992
1700 SWAP=A(K,JROW)	813 1410	6993
1710 A(K,JROW)=A(K,JCOLUM)	813 1420	6994
1720 A(K,JCOLUM)=SWAP	813 1430	6995
1730 CONTINUE	813 1440	6996
1740 CONTINUE	813 1450	6997
1750 RETURN	813 1460	6998

C	XXXXXX	B13	1470	6999
C		B13	1480	7000
C	END	B13	1490	7001
V	FOR B14,B14	B14	10	7002
C		B14	20	7003
C		B14	30	7004
C		B14	40	7005
C	SUBROUTINE DOTP(A,B,C)	B14	50	7006
C		B14	60	7007
C	* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72	*B14	70	7008
C	* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971	*B14	80	7009
C		B14	90	7010
C	XX	B14	100	7011
C		B14	110	7012
C	DIMENSION A(3),B(3)	B14	120	7013
C	C= A(1)*B(1)+ A(2)*B(2)+ A(3)*B(3)	B14	130	7014
C		B14	140	7015
C	RETURN	B14	150	7016
C	XXXXXX	B14	160	7017
C		B14	170	7018
C	END	B14	180	7019
V	FOR B15,B15	B15	10	7020
C		B15	20	7021
C		B15	30	7022
C		B15	40	7023
C	SUBROUTINE CROSP(A,B,C)	B15	50	7024
C		B15	60	7025
C	* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72	*B15	70	7026
C	* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971	*B15	80	7027
C		B15	90	7028
C	XX	B15	100	7029
C		B15	110	7030
C	DIMENSION A(3),B(3),C(3)	B15	120	7031
C		B15	130	7032
C	C(1)= A(2)*B(3) - A(3)*B(2)	B15	140	7033
C	C(2)= A(3)*B(1) - A(1)*B(3)	B15	150	7034
C	C(3)= A(1)*B(2) - A(2)*B(1)	B15	160	7035
C		B15	170	7036
C	RETURN	B15	180	7037
C	XXXXXX	B15	190	7038
C		B15	200	7039
C	END	B15	210	7040
V	FOR B16,B16	B16	10	7041
C		B16	20	7042
C		B16	30	7043
C		B16	40	7044
C	SUBROUTINE ROTATE(X,Y, XO,YO, PHI, XF,YF, XT,YT)	B16	50	7045
C		B16	60	7046
C	* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72	*B16	70	7047
C	* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971	*B16	80	7048
C		B16	90	7049
C	XX	B16	100	7050
C		B16	110	7051
C	XS = X-XO	B16	120	7052
C	YS = Y-YO	B16	130	7053
C	RHO= SQRT( XS**2 + YS**2)	B16	140	7054
C	ERROR= 0.0001	B16	150	7055
C	TESTX= ABS(XS)-ERROR	B16	160	7056
C	TESTY= ABS(YS)-ERROR	B16	170	7057
C	IF (TESTX) 1000,1000,1030	B16	180	7058
C	1000 IF (TESTY) 1010,1010,1020	B16	190	7059
C	1010 ZET= 0.0	B16	200	7060
C	GO TO 1110	B16	210	7061
C	1020 ZET= 1.570795*(YS/ABS(YS)) - XS/YS	B16	220	7062
C	GO TO 1110	B16	230	7063
C	1030 ZET= ABS(YS/XS)	B16	240	7064
C	IF (TESTY) 1050,1050,1040	B16	250	7065
C	1040 ZET=ATAN(ZET)	B16	260	7066
C	1050 CONTINUE	B16	270	7067
C	IF (XS) 1070,1060,1060	B16	280	7068
C	1060 IF (YS) 1100,1110,1110	B16	290	7069
C	1070 IF (YS) 1090,1080,1080	B16	300	7070
C	1080 ZET= 3.14159 - ZET	B16	310	7071
C	GO TO 1110	B16	320	7072
C	1090 ZET= 3.14159 + ZET	B16	330	7073
C	GO TO 1110	B16	340	7074
C	1100 ZET= 6.28318 - ZET	B16	350	7075
C	1110 CONTINUE	B16	360	7076
C	ZPP= PHI + ZET	B16	370	7077
C	XR = RHO*COS(ZPP)	B16	380	7078
C	YR = RHO*SIN(ZPP)	B16	390	7079
C	XT= XF + XR	B16	400	7080
C	YT= YF + YR	B16	410	7081
C		B16	420	7082
C	RETURN	B16	430	7083
C	XXXXXX	B16	440	7084
C		B16	450	7085
C	END	B16	460	7086
V	FOR B17,B17	B17	10	7087
C		B17	20	7088
C		B17	30	7089
C		B17	40	7090
C	SUBROUTINE CURFIT(X,Y,A, N, DY1,OY2, K1,K2)	B17	50	7091
C		B17	60	7092

C	* TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG-72	*817	70	7093
C	* PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971	*817	80	7094
C		817	90	7095
C	XX	817	100	7096
C		817	110	7097
C	DIMENSION X(22),Y(22),A(42),B(42),C(1)	817	120	7098
C	*****	817	130	7099
C		817	140	7100
C	XX	817	150	7101
C		817	160	7102
C	.....FOR THE WHOLE TABULATED TABLE	817	170	7103
C	X(I) = INDEPENDENT VARIABLE.....I=1,N (GIVEN)	817	180	7104
C	Y(I) = DEPENDENT VARIABLE.....I=1,N (GIVEN)	817	190	7105
C	N = LENGTH OF Y-VS-X TABLE (GIVEN)	817	200	7106
C	DY1 = 1ST OR 2ND DERIVATIVE AT LOWER END OF TABLE	817	210	7107
C	DY2 = 1ST OR 2ND DERIVATIVE AT UPPER END OF TABLE	817	220	7108
C	K1 = 1 .....DY1 = 1ST DERIVATIVE (GIVEN)	817	230	7109
C	K1 = 2 .....DY1 = 2ND DERIVATIVE (GIVEN)	817	240	7110
C	K2 = 1 .....DY2 = 1ST DERIVATIVE (GIVEN)	817	250	7111
C	K2 = 2 .....DY2 = 2ND DERIVATIVE (GIVEN)	817	260	7112
C		817	270	7113
C	THE DIMENSION C(1) MUST FOLLOW THE DIMENSION OF B	817	280	7114
C	MINIMUM DIMENSION OF B IS.....(2*N-2)	817	290	7115
C	DIMENSION OF A IS SAME AS B, BUT GIVEN IN MAIN PROGRAM	817	300	7116
C		817	310	7117
C		817	320	7118
C	XX	817	330	7119
C		817	340	7120
C		817	350	7121
C		817	360	7122
C	C(1)=0.0	817	370	7123
C	NRNG= 100	817	380	7124
C		817	390	7125
C	N1 = N-2	817	400	7126
C	C1 = X(2)-X(1)	817	410	7127
C	IF (C1) 1170,1170,1000	817	420	7128
C	1000 GO TO (1010,1020),K1	817	430	7129
C	1010 A(1) = 0.0	817	440	7130
C	A(1) = (DY1-(Y(2)-Y(1))/C1)/C1	817	450	7131
C	GO TO 1030	817	460	7132
C	1020 B(1) = -C1	817	470	7133
C	A(1) = -DY1/2.0	817	480	7134
C	1030 J = 1	817	490	7135
C		817	500	7136
C	IF (N1) 1150,1090,1040	817	510	7137
C	1040 IF (NRNG-N) 1150,1050,1050	817	520	7138
C		817	530	7139
C	1050 DO 1060 I=1,N1	817	540	7140
C	K = I+1	817	550	7141
C	J = J+1	817	560	7142
C	C1 = X(K)-X(I)	817	570	7143
C	C2 = X(K+1)-X(K)	817	580	7144
C	C3 = Y(K)-Y(I)	817	590	7145
C	C4 = Y(K+1)-Y(K)	817	600	7146
C	C5 = C3/C1-C4/C2	817	610	7147
C	C6 = C1/C2	817	620	7148
C	C7 = C1*C2	817	630	7149
C	A(J) = 1.0/(C6*(C1-B(J)-1))	817	640	7150
C	A(J) = (C5/C2-C6*A(J-1))*B(J)	817	650	7151
C	J = J+1	817	660	7152
C	B(J) = 1.0/(1-C1-C2)/C7-C6*B(J-1)	817	670	7153
C	A(J) = (-C5/C7-C6*A(J-1))*B(J)	817	680	7154
C	1060 CONTINUE	817	690	7155
C		817	700	7156
C	GO TO (1070,1080),K2	817	710	7157
C	1070 A(J+1) = (DY2-C4/C2+C2*A(J))/(C2*(B(J)-C2))	817	720	7158
C	GO TO 1120	817	730	7159
C	1080 A(J+1) = (DY2/2.0*A(J))/(1-2.0*C2+B(J))	817	740	7160
C	GO TO 1120	817	750	7161
C		817	760	7162
C	STATEMENTS 42 TO 44 ARE FOR N=2 ONLY	817	770	7163
C		817	780	7164
C	1090 C3 = K1	817	790	7165
C	C2 = 1.0/C3	817	800	7166
C	GO TO (1100,1110),K2	817	810	7167
C	1100 A(J+1) = ((Y(2)-Y(1))/C1-A(J)*C1-DY2)/(C1*C1)*C2	817	820	7168
C	GO TO 1120	817	830	7169
C	1110 A(J+1) = C3*((DY2+2.0*A(1))/(4.0*C1))	817	840	7170
C		817	850	7171
C	1120 J = 2*(N-1)	817	860	7172
C		817	870	7173
C	1130 J = J-1	817	880	7174
C	IF (J) 1170,1170,1140	817	890	7175
C	1140 A(J) = A(J)-B(J)*A(J+1)	817	900	7176
C	GO TO 1130	817	910	7177
C		817	920	7178
C		817	930	7179
C	1150 WRITE (6,1160)N,NRNG	817	940	7180
C	CALL EXIT	817	950	7181
C	1160 FORMAT(40N=15,3X9HIN CURFIT/31H .....N MUST BE IN THE RANGE	817	960	7182
C	1 13HBETWEEN 2 AND15/39H0*INCREASE DIMENSION OF B IN CURFIT	817	970	7183
C	2 19HIF N IS TOO LARGE /12H0B = 2*(N-1) )	817	980	7184
C	1170 RETURN	817	990	7185
C		817	1000	7186
C	XXXXXX	817	1010	7187
C		817	1020	7188
C	END	817	1030	7189
C				
C	FOR 818,818	818	10	7190
C		818	20	7191
C		818	30	7192
C		818	40	7193
C	SUBROUTINE CURVE(X,Y,A, XP,YP,DYP,N,IT)	818	50	7194
C		818	60	7195

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C * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B18 70 7196
C * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B18 80 7197
C 818 90 7198
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B18 100 7199
C 818 110 7200
C DIMENSION X(22),Y(22),A(42) 818 120 7201
C ***** 818 130 7202
C 818 140 7203
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B18 150 7204
C 818 160 7205
C.....USING A(I) COMPUTED IN CURFIT SUBROUTINE 818 170 7206
C XP = A PARTICULAR VALUE OF -X- (GIVEN) 818 180 7207
C YP = A PARTICULAR VALUE OF -Y- 818 190 7208
C DYP = DY/DX AT -XP- 818 200 7209
C IT = EFFICIENCY CONTROL INDEX (GIVEN) 818 210 7210
C IT = 1 .....ONLY YP IS COMPUTED 818 220 7211
C IT = 2 .....ONLY DYP IS COMPUTED 818 230 7212
C IT = 3.....BOTH YP AND DYP ARE COMPUTED 818 240 7213
C 818 250 7214
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B18 260 7215
C 818 270 7216
C 818 280 7217
C 818 290 7218
C IF (X(I)-XP) 1020,1020,1000 818 300 7219
1000 C1 = X(2)-X(1) 818 310 7220
DYP = (Y(2)-Y(1))/C1+A(1)*C1 818 320 7221
GO TO (1010,1100,1010),IT 818 330 7222
1010 YP = Y(1)+DYP*(XP-X(1)) 818 340 7223
GO TO 1100 818 350 7224
1020 N = N 818 360 7225
IF (XP-X(N)) 1050,1030,1030 818 370 7226
1030 N2 = 2*(N-1) 818 380 7227
C1 = X(N)-X(N-1) 818 390 7228
DYP = (Y(N)-Y(N-1))/C1-A(N2-1)*C1-A(N2)*C1*C1 818 400 7229
GO TO (1040,1100,1040),IT 818 410 7230
1040 YP = Y(N)+DYP*(XP-X(N)) 818 420 7231
GO TO 1100 818 430 7232
1050 I = 1 818 440 7233
1060 I = I+1 818 450 7234
IF (X(I)-XP) 1060,1070,1070 818 460 7235
1070 K = 2*I-3 818 470 7236
C1 = XP-X(I-1) 818 480 7237
C2 = X(I)-XP 818 490 7238
SLOPE = (Y(I)-Y(I-1))/(X(I)-X(I-1)) 818 500 7239
GO TO (1080,1090,1080),IT 818 510 7240
1080 YP = Y(I-1)+(SLOPE+A(K)*C2+A(K+1)*C1*C2)*C1 818 520 7241
GO TO (1100,1090,1090),IT 818 530 7242
1090 DYP = SLOPE +A(K)*(C2-C1)+ A(K+1)*(2.*C2-C1)*C1 818 540 7243
1100 RETURN 818 550 7244
C XXXXXX 818 560 7245
C 818 570 7246
C END 818 580 7247

V FOR B19,B19 819 10 7248
C 819 20 7249
C 819 30 7250
C 819 40 7251
C SUBROUTINE PAGE 819 50 7252
C 819 60 7253
C * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B19 70 7254
C * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B19 80 7255
C 819 90 7256
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B19 100 7257
C COMMON/DATA00/NS1L ,ALFAC ,CMAK ,ZHO ,FLAPDX,A1LRDX(2) 819 110 7258
C * ,TITLE(14) ,STORE(14) 819 120 7259
C 819 130 7260
C COMMON/DATA01/KIN ,KOUT ,KT1 ,KT2 ,LINEX ,LINES 819 140 7261
C 819 150 7262
C COMMON/DATA02/IFLG(15) ,EXECK(15) ,RAD ,PIE 819 160 7263
C 819 170 7264
C 819 180 7265
C 819 190 7266
1000 FORMAT(30H1J0BFLAG 1 2 3 4 5 6 7 8 9 10,2X,13A6,A2,3X, 819 200 7267
1 4HPAGE,/,2X,5HVALUE,1X,10I3,2X, 819 210 7268
2 5HALFA=,F6.2,2X,7HMACHNO=,F6.4,2X,6HFLAPD=,F6.2,2X,9HAILEROND=, 819 220 7269
3 2F6.2,2X,9HALTITUDE=,F6.2,2X,14,/,1X) 819 230 7270
C 819 240 7271
C 819 250 7272
C XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX B19 260 7273
C 819 270 7274
C 819 280 7275
C IF (NSTU-1971) 1010,1020,1010 819 290 7276
1010 NSTU= 1971 819 300 7277
NP= 0 819 310 7278
1020 NP= NP+1 819 320 7279
WRITE (KOUT,1000)(TITLE(I),I=1,14),(IFLG(I),I=1,10),ALFAC,CMAK,FLA 819 330 7280
IPDX,(A1LRDX(I),I=1,2),ZHO,NP 819 340 7281
LINES= 5 819 350 7282
C 819 360 7283
C RETURN 819 370 7284
C XXXXXX 819 380 7285
C 819 390 7286
C END 819 400 7287

V FOR B20,B20 820 10 7288
C 820 20 7289
C 820 30 7290
C 820 40 7291
C MAIN ROUTINE 820 50 7292
C TEST MATRIX INVERSION 820 60 7293
C 820 70 7294
C * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B20 80 7295
C * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B20 90 7296
C 820 100 7297

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C	XX	820	110	7298
C		820	120	7299
	DOUBLE PRECISION DELTA,AMAT(71,71),BMAT(71,71),CMAT(71,71)	820	130	7300
1000	FORMAT(10X,15,2F14.4 ) )	820	140	7301
1010	FORMAT( 1X,/,1X )	820	150	7302
1020	FORMAT(10X,5(1PF14.6) ) )	820	160	7303
C		820	170	7304
C	XXXXXXXXXXXXXXX>XX	820	180	7305
C		820	190	7306
C		820	200	7307
C		820	210	7308
	NOR= 5	820	220	7309
C		820	230	7310
	AMAT(1,1) = 1.032	820	240	7311
	AMAT(1,2) = 7.865	820	250	7312
	AMAT(1,3) = 3.216	820	260	7313
	AMAT(1,4) = 3.031	820	270	7314
	AMAT(1,5) = 10.32	820	280	7315
	AMAT(2,1) = 7.68	820	290	7316
	AMAT(2,2) = -6.39	820	300	7317
	AMAT(2,3) = 8.900	820	310	7318
	AMAT(2,4) = -1.02	820	320	7319
	AMAT(2,5) = 5.690	820	330	7320
	AMAT(3,1) = 3.030	820	340	7321
	AMAT(3,2) = -3.38	820	350	7322
	AMAT(3,3) = -11.67	820	360	7323
	AMAT(3,4) = 4.180	820	370	7324
	AMAT(3,5) = -3.60	820	380	7325
	AMAT(4,1) = -2.93	820	390	7326
	AMAT(4,2) = 5.670	820	400	7327
	AMAT(4,3) = 8.323	820	410	7328
	AMAT(4,4) = 9.073	820	420	7329
	AMAT(4,5) = 0.0378	820	430	7330
	AMAT(5,1) = -0.0578	820	440	7331
	AMAT(5,2) = 7.103	820	450	7332
	AMAT(5,3) = 9.992	820	460	7333
	AMAT(5,4) = 0.978	820	470	7334
	AMAT(5,5) = 15.14	820	480	7335
C		820	490	7336
	DO 1040 J=1,NOR	820	500	7337
	DO 1030 K=1,NOR	820	510	7338
1030	BMAT(J,K)= AMAT(J,K)	820	520	7339
1040	CONTINUE	820	530	7340
C		820	540	7341
	CALL DMATIN(BMAT,NOR,DELTA)	820	550	7342
C		820	560	7343
	DO 1070 K=1,NOR	820	570	7344
	DO 1060 J=1,NOR	820	580	7345
	CMAT(J,K)= 0.0	820	590	7346
	DO 1050 L=1,NOR	820	600	7347
1050	CMAT(J,K)= CMAT(J,K) + AMAT(J,L)*BMAT(L,K)	820	610	7348
1060	CONTINUE	820	620	7349
1070	CONTINUE	820	630	7350
C		820	640	7351
	CALL PAGE	820	650	7352
	WRITE (6,1020)((AMAT(J,K),J=1,NOR),K=1,NOR)	820	660	7353
	WRITE (6,1010)	820	670	7354
	WRITE (6,1020)((BMAT(J,K),J=1,NOR),K=1,NOR)	820	680	7355
	WRITE (6,1010)	820	690	7356
	WRITE (6,1020)((CMAT(J,K),J=1,NOR),K=1,NOR)	820	700	7357
	WRITE (6,1010)	820	710	7358
	WRITE (6,1010)	820	720	7359
	WRITE (6,1020)DELTA	820	730	7360
	STOP	820	740	7361
	END	820	750	7362